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VOLUME 8, No. 4 **APRIL 1956**

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WORLD CROPS

Vol. 8, No. 4 — APRIL 1956

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Editorial Comment

U.K. farm machinery

AT the time of going to press the most recent figures available for British farm machinery tell a somewhat disturbing tale. Both at home and abroad sales were not recovering in late 1955 with the normal surge after the summer and harvest period. In this industry, as in other farmer-supplying industries, the pattern of trade has always been seasonal. Now, however, a seasonal recovery period has been much less marked in its activity. For home sales the discouraging effects of credit restraints and high interest charges provide an obvious explanation. But it is Treasury 'theory' (or should the word 'hope' be preferred?) that production in lesser demand at home will be sold to foreign customers instead. Unfortunately this desirable *quid pro quo* development is not revealed by the figures—export sales at the end of 1955 were showing poor seasonal recovery as well.

It would be easy to exaggerate this somewhat sombre picture. It may be nothing more than a temporary trend that has been so disappointingly measured in a report issued by the Agricultural Engineers' Association. Still, wise business men and economists cannot ignore new trends any more than travellers can ignore weather forecasts. Why is the overseas demand also sluggish? A likely answer is one that several other British home-and-export industries can also give—sharply intensifying German competition. Mechanisation in West Germany's agriculture is making rapid progress. Since 1950 the number of tractors has risen from 100,000 to 400,000. In a period not much longer the number of milking machines has risen from 6,000 to 70,000. Farmers there are prosperous and long-term credits at favourable charges are available to them. But a vigorous demand at home has not lessened the supply available for export sales. On the contrary, good business at home is proving itself to be the springboard foundation for increased business abroad. Europe, one of the best markets for British farm machinery, is increasingly buying German machines. In a single year sales of German tractors have advanced sharply—sales of the British product have not.

If this proves no more than a passing market change, so much the better. If it persists, however, some grim re-thinking is clearly needed. The old view that vigorous export sales must be built up on a strong home market has been treated with suspicion by successive British governments; greater faith has been set upon the policy of restricting home demand to make more goods available for other countries. Unfortunately discouraging Peter as a customer at home seems to have a similarly discouraging effect upon Paul as a potential foreign customer.

Liquidate those caterpillars!

SCIENTISTS of the Virus Research Unit of the Agricultural Research Council at Cambridge have discovered a virus which kills the caterpillars of the cabbage white butterfly and reduces them to liquid. The disease, which spreads rapidly, can be started by spraying cabbages with a weak suspension of the virus. Once infected, the caterpillars take about four days to die, and the highly infectious liquid of the liquefying larvae is spread further by the action of rain.

The report, which was published in *The Times*, went on to say that during the 1955-56 winter, butterflies were to be bred under artificial light, and the caterpillars, having been infected with the virus, would be distributed in the spring. It is hoped that by this method the control of the pest may be obtained. The discovery suggests the possibility that other pests may similarly be controlled by means of virus infection.

From plasma to soils?

THE use of dextran as a blood-plasma extender in medicine is already well known. New research reported in America (*J. Agric. Fd Chem.*, 1955, 3, 1028) suggests that dextrans, which are glucose-polymers produced by bacterial fermentation processes, may prove also to be useful soil conditioners. Few known substances resemble dextrans in their combination of huge molecular weight and water solubility. The 'clue' to soil-conditioner use was the finding of dextrans as natural constituents of some soils.

So far experiments have shown that certain dextrans exercise a good and durable stabilising effect on soils; in pot and field tests, this effect has had a very beneficial influence upon seedling emergence, plant-growth rate, and final yields for crops such as beans and corn. Whether dextrans can be developed as economic soil conditioners is hardly predictable at this stage. Economics rather than effectiveness in action has been the Achilles heel of other synthetic polymers. Dextrans are made from sugar, at least a reasonably low-costing raw material. In this early experimental work the rates of dextran application have been round about 1½ oz./sq. ft. of soil, which is a little below the rate recommended for most other synthetic conditioners. On the other hand, the synthetic plastics-type substances are immune to decomposition in soil by micro-organism attacks; dextrans may well prove to be bacterially consumable.

A variety of dextrans can be produced by varying the conditions of the fermentation process. It seems likely that different dextrans will prove to be the most efficient conditioners for different soil types, *e.g.*, one will

specifically suit clay soils, another will suit loams, etc. One important asset of dextrans is their ease of application. They are free-flowing powders which can be readily incorporated with top-soils by using ordinary farm implements. In some contrast plastics-type chemical conditioners have presented awkward application problems especially in the wetter climates. However, much more work will be needed to establish a practical and economic case for dextrans as conditioners for farm soils. At the moment they are best 'summed-up' as interestingly hopeful.

'My kingdom for a horse'

SINCE the war farm mechanisation in the Netherlands has expanded enormously, and in this connection it is interesting to try to realise what will, in the end, be the number of farm tractors used in this country as a result of this development. Rhetorically speaking one might say: 'When shall we stand at the grave of the last horse?'

Until recently only few efforts were made to find out what number of farm tractors might be expected to be used in the Netherlands in the near future. A recent study, however, has given us something to go by. It is expected that in 1970 58,000 tractors, including 8,000 horticultural tractors, will be in use, quite an appreciable number considering the fact that in 1950 there were only 24½ thousand tractors in this country.

A fortunate secondary conclusion of this study was that the grave for the last horse will not have to be dug within a measurable space of time if ever.

When for every new tractor on existing farms an average of two horses should be done away with (this ratio was not even reached in the last few years), the number of farm horses in 1970 would still amount to over 155,000 (in May 1954 some 200,000).

Soviet farming

IT is doubtful whether a more objective outside appraisal of Russia's agriculture has yet been made than in Sir Peter Greenwell's paper for the Farmers' Club, read earlier this year and now published in the club's Journal (1956, Part I). A member of the 1955 Agricultural Delegation to Russia, Sir Peter was able to provide a clear account of both the State farm and collective farm systems, remarkably detailed when the shortness of the delegation's visit and the vastness of Russia are considered. At least in agriculture it seems possible to discuss Russian methods without political prejudices. The dual policy of State farms and the collective system is an understandable compromise. Revolution has not altered the fact that half the total population are peasant farmers, or the fact that peasant farming is apt to be backward and non-expansive. The collective system is based upon controls—minimum labour efforts for the collective farm by each peasant, fixed buying-prices for fixed quotas of produce with graded higher prices for graded surpluses to the quota, and limited 'personal' production by peasants on their own small (½ to 2½ acres) holdings. Adjustments to these controls are made if food production is inadequate; thus, within recent years, although a production 'crisis' has been denied, the buying-prices for first quotas have been increased and at the same time the labour call upon peasants for work on the collective farms has also been increased. This has made the return for labour considerably more attractive.

Perhaps the most outstanding impression to be derived from Sir Peter Greenwell's paper is the vast acreage of virgin land still awaiting the plough and the drill. The Western world takes the view too readily that all reserves of productive land have been brought into action. Russia's current plans include the ploughing of 75,000,000 acres of virgin soil; new State farms of 1,000,000 and 85,000 acres were mentioned, the latter being visited by the delegation. One comment in the paper seems particularly illuminating: 'The political system seems to demand quick results. Agricultural development is a slow process normally . . .' This may well explain why high political careers in Russia have been sensitive to the 'ups and downs' of Russian farming results. Administrative rather than farming or technical experience is placed at the head of collective organisations, but this seems to be essential when such huge projects are involved.

Safety precautions for agriculture

FOR the first time the British agricultural worker is to have protection against danger in his work. The long-awaited Agriculture (Safety, Health, and Welfare Provisions) Bill (first reported in WORLD CROPS, 1956, **8**, 95), presented in the House of Commons in February, will extend to agriculture measures for the safety and welfare of its workers comparable to those that industrial workers enjoy under the Factory Acts.

The bill is founded on the recommendations of the Gowers Committee, which reported in 1949. It is largely concerned with the safety of agricultural workers, though it will also lay down conditions of hygiene to be observed in the interests of health. The bill is mainly an enabling measure giving Agricultural Ministers power to make regulations for a comprehensive range of likely accidents.

Presenting the bill, the Minister of Agriculture, Mr. Heathcoat Amory, said that British agriculture is today the most mechanised in the world. In 1939 it was estimated there were about 55,000 agricultural tractors in the country; today there are something like 470,000. These developments, said the Minister, had caused a flow of accidents. Each year there were about 25,000

sufficiently serious accidents to give rise to claims under the Industrial Injury Scheme; industrial injury benefit amounting to about £500,000 a year was paid. Each year there were about 150 fatal accidents.

Obligations for workers' safety will include first-aid boxes on all farms where workers are employed. Another clause is aimed at preventing accidents to children under 13 years by preventing them from driving or riding on vehicles, machines and implements on the farm. A considerable number of accidents to children arise on farms from such causes as falling under tractors or towed implements on which they are riding.

It is not proposed under this bill to appoint a large new inspectorate or a fresh group of official visitors. Visits will be carried out by the present staff of the Department of Agriculture who are engaged in visiting farms.

More corn per acre

A COMBINATION of good fertilisation and supplementary irrigation can ensure high-yield farming year in and year out.

This fact was demonstrated by the results from a corn experiment conducted by the Mississipi Agricultural Experiment Station over a period of three years. In these trials four rates of nitrogen (adequate P_2O_5 and K_2O were applied) were tested with and without supplementary irrigation. The results were as follows:

Increased yields due to irrigation of inadequately fertilised corn were only 2.4 bushels per acre in the first year; 2.1 bushels per acre in the second year; and 17.5 bushels per acre in the third year. Average yield increase for the irrigated corn that was well fertilised amounted to 19.8, 21.7 and 36.8 bushels per acre over the three-year period.

The Mississipi scientists concluded that with high rates of nitrogen and supplementary irrigation, farmers could regularly harvest approximately 100 bushels of corn per acre under the conditions of the experiment.

Forestry statistics

MAJOR timber-producing and -consuming countries of East and West Europe and the U.S.A. have agreed to co-operate in developing and exchanging statistics about their forest resources, industries and trade.

These representatives of 14 countries* have just concluded a meeting in Geneva, called jointly by the Food and Agriculture Organisation of the United Nations and the Economic Commission for Europe.

They reached unanimous agreement on a minimum programme of statistics, which all the participating countries undertook to implement in the near future. In addition the group decided to assemble forward estimates of fellings in 1960 and 1965 and to supply this information to the secretariat. Similar five- and ten-year forward estimates are to be assembled in future.

Many details of the programme still are to be decided at further meetings of the Working Party and of specialist groups, which are to be held during the next two or three years. The next session of the full Working Party will be held in Geneva in November next.

Liquid fertilisers

IMPORTANT developments are taking place in the U.S.A. in the use of high-analysis liquid fertilisers for direct application to the soil. The U.S.A. is the only country known to be producing nitrogen fertilisers in the form of solutions. In 1954, such liquid fertilisers accounted for 800,000 metric tons of the total nitrogen production of the U.S.A., or 53%. The estimated figures for 1955, according to the latest information from FAO ('An Annual Review of World Production and Consumption of Fertilizers, 1955'), are 846,000 metric tons or 51% of the country's total nitrogen production. This represents about one-seventh of the total world production of nitrogen.

Only a part of the anhydrous ammonia, which constitutes most of this liquid fertiliser production, is, however, applied directly to the soil. Probably more than half is used for ammoniation of superphosphate and similar purposes. In 1954, it is estimated that anhydrous ammonia applied direct represented 15½% of total nitrogen consumption in the U.S.A., and solutions and 'aqua ammonia' another 2½%. It has been forecast that in 1956–57 these figures will have risen to 19 and 4%, respectively.

Anhydrous ammonia is the most concentrated of all nitrogen fertilisers, containing 82% of nitrogen. Readily liquefied at moderate pressure, it can be transported in cylinders or steel pressure-tanks. Despite its high volatility, if injected into the soil at a depth of 4 in. or more, it is fixed by the soil colloids and is readily available to plants, either as the ammonium ion or, after nitrification, as nitrate. Liquid fertiliser solutions are not so highly concentrated, consisting of diluted ammonia alone or mixed with other very soluble high-nitrogen fertilisers such as urea or ammonium nitrate, to give nitrogen ranging from about 30 to 40%. These are applied under low pressure at a depth of 2 in. or more.

The use of anhydrous ammonia started in California in the early 'thirties for irrigated crops, by dissolving it in the irrigation water. Its use for non-irrigated crops, however, began only in 1947, on cotton in the Missis-

* Austria, Belgium, Finland, France, Federal Republic of Germany (FAO), Western Zones of Germany (ECE), Italy, Netherlands, Norway, Sweden, Switzerland, United Kingdom, U.S.A., U.S.S.R.

sippi Delta. The practice quickly spread to other Delta states and by 1950 anhydrous ammonia was beginning to be used in the North Central states. In 1949–50, 28% of the total fertiliser nitrogen used in the State of Mississippi was applied in this form; in 1952–53, the State of Illinois used about 22% of its nitrogen as anhydrous ammonia directly applied.

In the year ended 30 June, 1953, anhydrous ammonia was reported to have been used in 40 states for direct application. In the following year anhydrous ammonia consumed was 87% more than in the previous year. About 10,000 applicators of all types are estimated to be in use in non-irrigated areas of the U.S.A. It is estimated that storage capacity will need to be doubled in the next two years if the use of anhydrous ammonia continues to expand at the present rate.

Farm adoption scheme

THE farm adoption scheme of the Association of Agriculture, which is now entering its fifth year, has proved extremely popular in Britain. The Association is to be congratulated on its most recent step—the addition of four Canadian farms to the scheme. In making the announcement in London recently the Association noted that there are now some 1,400 enrolments, covering colleges and schools in almost every county of the British Isles and there are a number of schools overseas that have enrolled.

There are now eight British farms and two New Zealand farms in addition to the Canadian farms. It is hoped eventually to include several farms in Australia.

The school or college that adopts an individual farm receives a folder, which contains maps of the country and a survey map of the farm buildings, four pages of photographs showing the farmer and his family, livestock etc., and printed sheets giving a detailed description of farming practice, fields, livestock, water, labour etc. It may also be supplemented by a yearly letter from the farmer.

Geography teachers are those that have made most use of this scheme but teachers of social studies, biology and rural science also find useful material.

We wish the scheme continued success and those who desire to learn more of the scheme may write to The Association of Agriculture, 53 Victoria Street, London, S.W.1.

Phosphate and potash for pastures

PHOSPHATE is of outstanding value as a fertiliser for grassland. It is particularly good for clover and young herbage plants generally, because it stimulates vigorous development of the roots. In addition to increasing the quantity of herbage produced, it also tends to improve the quality, thus counteracting the adverse effect of nitrogen in this respect.

The results of a survey of grassland carried out in Northern Ireland showed that although 68% of the fields having soils containing a very high percentage of phosphate had ' good ' or ' fair ' herbage, only 19% of those in which the soil was deficient in phosphate had herbage of equal quality. As the proportion of available phosphate decreased so also did the proportion of fields having good or fair herbage. This demonstrates clearly the close relationship that exists between the quantity of phosphate in the soil and the quality of the herbage produced.

The results of soil testing show that at least 75% of the soils in Northern Ireland are deficient in phosphate; hence the necessity to apply a phosphatic fertiliser when manuring grassland, for adequate phosphate is essential to obtain good grass. Indeed, phosphatic fertilisers have been described as the basis of grassland improvement in Northern Ireland.

A large proportion of the phosphate applied becomes changed in the soil to a form not available to plants. This is why the dressings normally recommended are heavier than those for other fertilisers. In the case of established swards, it is better to give a relatively light dressing of a phosphatic fertiliser every year than to apply heavier dressings less frequently. A sound practice is to apply a dressing of about 3 cwt. of superphosphate, or 4 cwt. of high-grade basic slag, per acre annually. Superphosphate is especially suitable for the lighter and drier soils and basic slag for those that tend to be heavy and damp.

The plant food in potassic fertilisers is soluble in water and so is readily available to plants. Despite this, however, these fertilisers are not washed out of the soil to any appreciable extent by drainage. In general, potash induces stamina and promotes quality in herbage plants and, as with phosphate, it tends to neutralise the adverse effects of excess nitrogen. Furthermore, potash has a special value in encouraging clovers.

On light land, and especially during dry seasons, a dressing of potash is very beneficial to established pastures. Indeed, the response to dressings of phosphate applied to light soils during dry seasons may be poor unless potash also is used. Rapid deterioration of the sward, beginning with the disappearance of the clovers and continuing until the pasture is largely composed of poor species of plants and of mosses, is likely to occur in the absence of sufficient potash. A suitable dressing is from ½ to 1 cwt. of muriate of potash, or from ¾ to 1½ cwt. of potash manure, per acre annually.

When a potassic fertiliser is being used for hay or grass on land that is deficient in phosphates, much of the benefit will be lost unless a phosphatic fertiliser is also used.

Problems of Reclaiming Certain Infertile Areas in the Sudan Zone of Northern Nigeria (Kano Province)

E. B. DENNISON, B.SC., DIP. AGRIC., DIP. TROP. AGRIC.

There are a number of areas in the Kano Province where, owing to continuous cropping or over-grazing, the land is in such a poor condition that crops are very mediocre and extremely patchy. These areas, of anything from 50 to 500 acres in extent, give such uneconomical yields that they are eventually abandoned by the local population. They soon revert to a scrub type of vegetation or, where grazing seems to be particularly heavy, to bare patches in the dry season. During the wet season they become covered with Kashin Yawo (Aconthospernum hispidum).

A NUMBER of experiments have been conducted over the last three years on a scrub area at Badume, just over 20 miles north of Kano. The aim was to discover how this type of land could be rejuvenated for the purpose of either growing crops that would give an economical return or establishing a high-yielding pasture. It was discovered that the area had been farmed within living memory until the land had become exhausted, no attempt being made to maintain fertility by using fertilisers or manure. Some of the land was cropped up to five years ago, but most of it went out of cultivation just after the turn of the century. The area is now used for grazing and has further deteriorated owing to overstocking.

Vegetation

The natural vegetation of Badume is typical of these scrub areas. It consists of a variety of shrubs, usually about two feet high, with bare patches in between; these patches are comparatively sparsely covered by grasses and legumes in the wet season. As it was considered that one of the first steps to improve the area would involve the eradication of the shrubs some counts were taken on a number of $\frac{1}{4}$-acre plots.

Four species were found to make up 99% of the natural shrub cover (see Table 1).

TABLE 1
PERCENTAGE OF SPECIES FORMING SHRUB COVER

Hausa name	*Scientific name*	*Approximate percentage*
Sabara	*Guiera senegalensis*	80%
Geza	*Combretum micrantum*	11%
Margo	*Cassia kotschyana*	5%
Rumfu	*Cassia gorantensis*	3%

Where the aim has been to establish a pasture, either as a permanent grazing area or as a half-way stage in improving the fertility, it has been necessary to erect a fence to keep out the local stock. Moreover, it was discovered that it is essential to destroy the unwanted shrub vegetation and sow the grass before fencing the area. Once the area is fenced the Sabara (*Guiera senegalensis*) is protected and unless it is destroyed immediately it will take advantage of this fact and increase in size at an alarming rate. This will make eradication more costly and difficult in the long run. It should be explained that the reason for this increase in growth is that in the natural state the plant is kept in reasonable check both by grazing animals eating the very young shoots and by the local people cutting the softer branches for bedding.

Eradication

A number of experiments to try and eradicate the shrubs in the area were attempted. It was discovered that of the methods of cultivation, spiked harrowing and subsoiling were of no use for killing the shrubs. The disk plough and the Marden Brush Cutter were by far the most effective of all the implements tested. The disk plough was a much less expensive implement to buy and was easier to transport, but on the other hand the Marden Brush Cutter had the advantage that it left some of the natural self-sown grasses and legumes, which formed a

The prolific cover of cowpeas, just one month after planting, is clearly shown in this photograph. The area to the right of the illustration received 5 cwt. of superphosphate per acre and the plants are twice as large

cover over the ground when the rains began, thus reducing the effect of surface wash. Disk ploughing left the soil very bare and the run-off after a rainstorm was considerable. This was particularly so if subsoiling was done first to help the plough penetrate deeper and it was therefore decided that it was questionable whether subsoiling was economic or even advisable before ploughing.

Three chemical control methods for killing the shrubs were tried and it was found that they were all completely effective even up to dilutions of 1 in 20. 2,4-D and 2,4,5-T seemed to be slightly quicker in their action than Trioxone M.* They were found to be a comparatively expensive method of control and the chemicals also had the very great disadvantage that they killed such legumes as were already present on the area. Hand cutting was tried at various times in the year but was found to be comparatively ineffective.

Fertilisers

In 1953 a quantity of deteriorated superphosphate was available and ten tons was dumped on a part of the experimental area. No accurate details concerning the rate of application were taken but on one area approximately 6½ cwt. per acre was applied and the effect soon became apparent. A very good take of grass occured a year later and the area was continually and heavily grazed for one week at the end of the wet season after the grass had seeded. It was estimated that the vegetative cover consisted of approximately 700 to 800 grazing hours per acre. These observations indicated a possible reason for the deterioration of the land and immediately led to further investigations on the use of superphosphate.

Thus in 1954 the effect of superphosphate was more fully examined at Badume to discover if a lower, and therefore more economic, application of fertiliser could be used to improve this area. An experiment was laid down using four levels of superphosphate and three methods of cultivation (disk ploughing, spiked harrowing and subsoiling) It was discovered that of the fertiliser treatments the highest application, 4 cwt. per acre of superphosphate, gave the highest yield of dried Kyasuwa (*Pennisetum pedicullatum*).

Disk ploughing gave a far better yield than the other treatments. As would be expected, the plot that combined 4 cwt. of superphosphate with disk ploughing gave the best results. Even on this plot the yield of Kyasuwa hay was half what is expected from land in good heart. Nevertheless it was five times better than the plot that was untreated and was a strong indication of the way that the land could be improved.

Gaya Stock Farm was another place, just over 40 miles south of Kano, where the land had been allowed to deteriorate, but in this case Kashin Yawo had invaded the area. After a number of years of trial it was found that a good method of producing a pasture, having already cropped the land for one year, was to disk plough, disk harrow, sow the seed and then cover it over by dragging brush wood behind a tractor. This treatment gave a very satisfactory pasture of Kyasuwa and Gamba (*Andropogon gayanus*), provided sufficient good-quality seed was sown at the correct time.

Grasses

The two grasses that have mainly been tried out in Kano Province up to the present time are Kyasuwa and Gamba. Kyasuwa is an annual which is often found on these areas as part of such natural grass cover as is present. It was the easiest grass to establish and often gave a good pasture in the first year. Unfortunately, being an annual, it is difficult to manage and can be easily wiped out by overgrazing or cutting too early in the season before the seed has ripened.

Gamba, on the other hand, is a perennial. It is more difficult than Kyasuwa to establish from seed and was found to be far more likely to fail if the seed bed was imperfect or the sowing was not done at the optimum time. Another disadvantage is that it was almost essential to wait until at least the second wet season before grazing it. On the other hand it was found that once it was properly established it could be harvested when desired without much fear of causing permanent damage to the sward. It can also be artificially propagated by splitting up and transplanting established roots. This method was used for planting along the bunds to reduce soil erosion.

The Gaya Stock Farm method of pasture establishment was tried out at Badume but gave poor results although it did show that this series of cultivations almost entirely eliminated the Sabara and other shrubs. The failure of the grass was probably due to the fact that the operations were carried out rather late in the season and also the grass seed was not sown at what is now considered to be an ideal time in the sequence of operations.

Dawaki Tofa results

In 1955 the lessons learnt at Badume and Gaya Stock Farm were tried out on over 150 acres at a place called Dawaki Tofa (about ten miles north of Kano). This area was similar to Badume except that there seemed to be a greater percentage of Sabara bushes compared with other shrubs and the average height was quite low, being no higher than one foot over most of the area. The whole of Dawaki Tofa was treated in a similar way to Gaya Stock Farm except that 1 cwt. of superphosphate was applied just before disk harrowing. The sequence of events was therefore disk ploughing, application of fertiliser, disk harrowing and seeding. Only a small area was brushed after sowing.

A number of quite interesting observations were made at Dawaki Tofa. It was found that a higher seed rate gave a far better take and also helped to prevent soil wash; 20 lb. or more of seed chaff per acre would be advisable in any future trials. It was also considered that a higher rate of fertiliser application would have been worth-while and a quicker and more healthy growth of grass would have resulted. Another advantage would have been that a more even spread of fertiliser on this comparatively rough ground would have been possible with a higher application. The lessons learnt at Dawaki Tofa and Badume seemed to indicate that 4 cwt. or more of fertiliser is needed on these run-down areas. One of the main reasons for infertility rests in the fact that there is a distinct lack of phosphate.

It had never been quite definite whether or not brushing after sowing

*2,4-D and Trioxone M were kindly supplied by Plant Protection for this trial. All the chemicals were sprayed on to drip point.

These photographs show the difference in grass cover between an area (left) *where the grass was sown directly after disk harrowing and before a rainstorm and an area* (right) *where rain had occurred between disk harrowing and the sowing of the seed. The seed rate on the area* (left) *was slightly higher but does not fully account for the far greater take of grass, but it can be assumed that the sowing of the seed directly after disk harrowing and before a rainstorm was highly advantageous. It is considered that the grass seed is liable to be blown away if it is sown on an area where rain has destroyed and beaten flat the tilth produced by the disk harrow*

was really worth-while and at Dawaki Tofa there seemed to be no apparent difference between the grass that had been treated in this way and the grass that had received no treatment. Although this observation cannot be considered definite proof, it seemed to suggest that brushing was not necessary. Other treatments, such as spiked harrowing and chain harrowing, have been suggested as after-sowing cultivations. The main reason for concern in this respect is that in this district a squall often arises before a rainstorm which would be very likely to blow the seed away if it was not covered lightly.

The most important observation at Dawaki Tofa was that grass sown *directly* after disk harrowing and *just* before a rain storm gave a far better take than grass that was sown when a rainstorm had occurred *between* the disk harrowing and the sowing. It seemed very probable that this fact was more important than any after-sowing treatment. Some form of seed distributor, drawn directly behind a disk harrow, would probably be the ideal arrangement.

Crops and legumes

So far the attention of the reader has been focused on the establishment or improvement of pasture on these infertile areas. A number of trials have also been made both with crops and legumes. The local inhabitants consider that areas of Sabara bush, such as Badume, are so infertile that it is not worth-while planting crops on them. When groundnuts were grown on a plot that received 3 cwt. of superphosphate per acre the plants looked larger and healthier than the local farmers' crops on the adjoining farm land. Guinea corn (*Sorghum* spp.) did not respond spectacularly to fertiliser the first year but it may well be that this crop would give better results the year following fertilisation as seems to be the case with grass.

A number of legumes have been tested on this land. The aim was to find a quick cover crop that could be used in association with grass to prevent erosion, and it was also hoped that at the same time it might be possible to discover a legume that would improve the soil. Over a two-year period it was found that of the ten species tested pigeon pea (*Cajanus cajan*), cowpea (*Vigna catiang*), soya bean (*Glycine soja*), Mucuna (*Stizolobium aterinum*) and *Indigofera echinata* were by far the most easy to establish on the area at Badume whereas *Stizolobium javanica*, *G. javanica*, *Centrosema pubescens*, *Phaseolus lathyroides* and *Stylosanthes gracilis* were either slow to germinate or difficult to establish. Of the crops that were tested cowpeas gave by far the best and quickest cover to the ground and they also gave a very noticeable response to 5 cwt. of superphosphate per acre.

It was observed that once the ground was exposed, either by disk ploughing or by other cultivations, the rain caused a considerable amount of surface soil wash. This erosion not only washed away a good deal of the soil but an even more serious effect was that it also removed a lot of the grass seed. It was found at Dawaki Tofa that 1-ft. bunds were of little use on even slightly sloping land once the area had been ploughed up. Effective bunds would probably have to be two feet, or even more, which would considerably add to the expense of reclaiming these areas.

Erosion prevention

Owing to the undesirable effects of erosion it is essential that every possible effort should be made to get the ground covered as quickly as possible after the first rains. Planting cowpeas with the grass may well be the answer. Once the grass was established they could either be fed off or cut for silage so as to prevent the young seedlings from being 'smothered'. Once again it is important to apply *adequately* large amounts of superphosphate to encourage the cowpeas to grow quickly and give sufficient cover to the ground.

Summary and conclusions

A good deal of information has now been gathered on how to improve these infertile soils around Kano in the Sudan zone of northern Nigeria.

Continued on page 136

Overhead Irrigation

Water Supplies and Distribution from Source to Sprinkler

J. S. STOWER

(*British Overhead Irrigation Limited*)

In this note Mr. Stower adds further information to his first article on overhead irrigation, which was published in WORLD CROPS, 1955, **7**, 329. *He also provides information on the methods used to estimate the rate of flow of water in the small and large streams that can often be utilised for irrigation purposes.*

THE scope of an irrigation system is governed by the available water supply. When the details of a proposed installation are being considered, the first matter to be determined is the rate and frequency of the application that is required, in terms of rain equivalent in inches. One inch of rain on an acre represents 22,600 gal. of water. If, therefore, the area to be irrigated is 10 acres and the application required is ½ in. of rain each week, the total weekly water supply needed will be 113,000 gal.

Most modern types of irrigation equipment are designed for rotational watering. The spray lines, or sprinklers, are generally made of light aluminium alloy and are easily moved about. An economical, planned system is usually based on a rotation of one week's, or in some cases two weeks' duration. If we assume that 113,000 gal. of water is to be put down on 10 acres of cultivated ground in one week, or say 44 working hours, then the hourly rate of water necessary will be 2,568 gal., or in round figures, 2,600. The water can be obtained from rivers, streams, wells, boreholes, reservoirs, or even town mains. Quite often what appear to be small streams can be harnessed to an irrigation system and the water stored in reservoirs, which are replenished over a 24 hour period.

If the water supply is not adequate, then the system must be designed on the basis of a lower rate of application.

It is a simple matter to measure the rate of flow of a small stream, or a large stream, and the method generally used is described below.

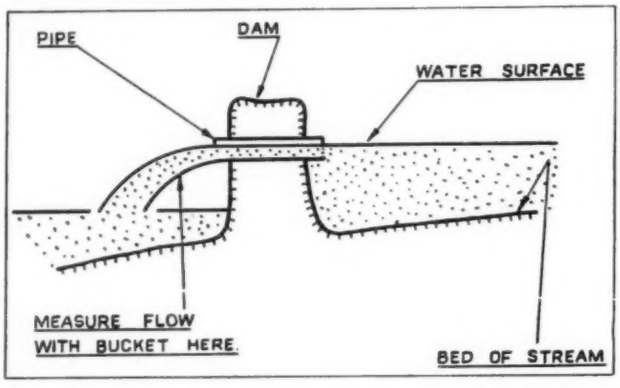


Fig. 1. A diagrammatic representation of the method of measuring water supply from a small stream

Measuring Natural Water Supplies

Small streams.—A dam should be built across the entire width of the stream—with bricks, turf, clay etc.—and, in the dam thus made, insert a short piece of earthenware or iron pipe to form a spout. See Fig. 1.

The measurement should then be taken by two persons, one to take the time and the other to catch the water. The latter should have, say, a 3-gal. bucket, and at a signal from the timekeeper, he should instantly thrust the bucket under the spout for exactly 10, 15 or 30 seconds, taking it away again exactly at the signal of the timekeeper.

The quantity of water in the bucket should be measured by a pint or quart measure. The flow can then easily be calculated in gallons per minute or hour.

If the flow is rather too much to measure in this way, two, three or more pipes may be inserted in the dam, and when they are all running steadily —with no ' build up ' of water behind the dam—each of them should be measured separately.

It is not necessary of course, that each spout be made to deliver the same quantity, that is the spouts need not be the same diameter providing the discharge of all are added together.

Large Streams.—The stream should be dammed up a few inches and on top of the dam a ' Weir Gauge Board ' should be fixed as shown in Fig. 2.

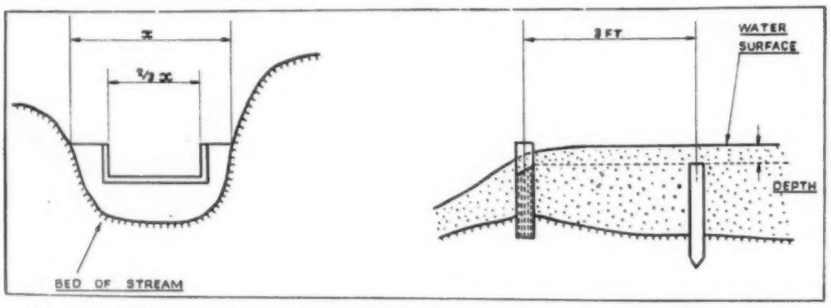
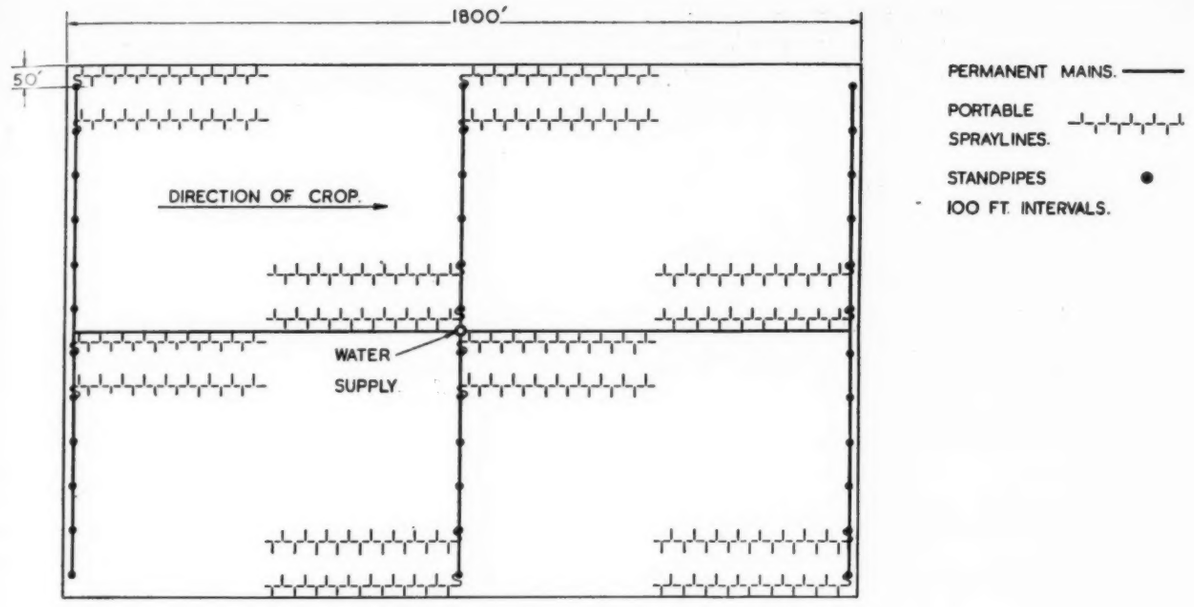


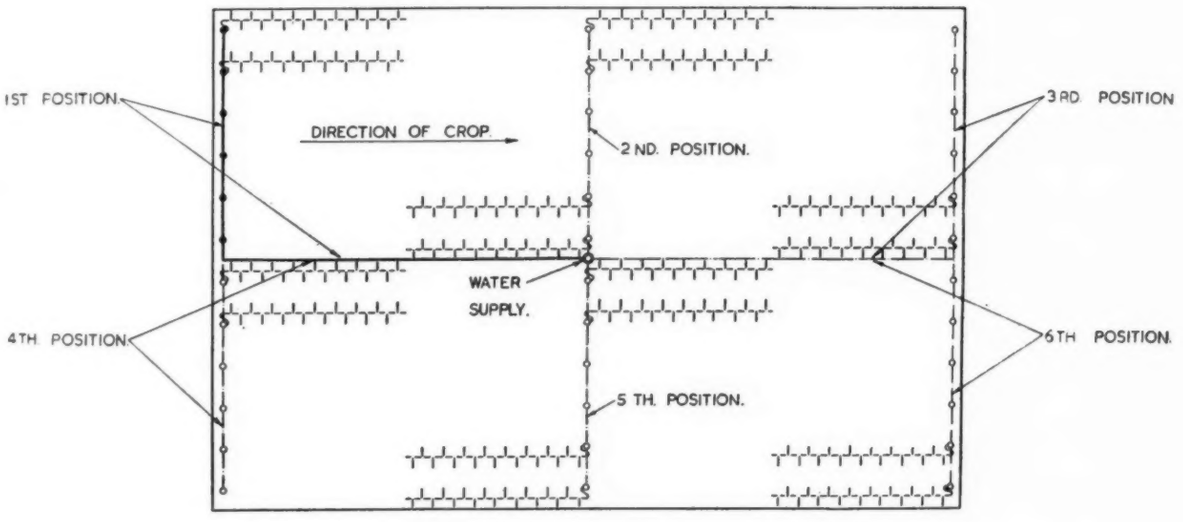
Fig. 2. A diagrammatic representation showing the method used to measure the water flow in a large stream. The Weir Gauge Board is used in this method

Bed of Stream

A notch should be cut in the Weir Gauge Board and chamfered to a thin



PERMANENT MAINS.



PORTABLE MAINS.

Fig. 3 (above) *and Fig.* 4 (below). *These figures show clearly in diagrammatic form a system with permanent mains* (*Fig.* 3) *and a system with portable mains* (*Fig.* 4)

edge. The width of the notch should be about two-thirds the width of the stream.

A peg should be driven into the ground about three feet back from the board, in the still water, with its top exactly level with the bottom of the notch. (The Weir Gauge Board should be set perfectly level, and this may be tested and also the level of the peg by observation, just as the water rises to the bottom of the notch.)

If the width of the notch is then taken and the depth of the water passing over it (as measured from the top of the peg, three feet back, to the surface of the water), the discharge in gallons per minute can then be easily calculated from Table 1.

TABLE 1
DISCHARGE OF WEIR BOARDS

Depth in.	*Discharge per ft. width gal./min.*	*Depth, in.*	*Discharge per ft. width, gal./min.*	*Depth, in.*	*Discharge per ft. width, gal./min.*
$\frac{3}{8}$	7	$1\frac{5}{8}$	66	$3\frac{1}{2}$	209
$\frac{1}{2}$	11	$1\frac{3}{4}$	74	$3\frac{3}{4}$	232
$\frac{3}{4}$	20	$1\frac{7}{8}$	82	4	256
$\frac{7}{8}$	26	2	90	$4\frac{1}{2}$	305
1	32	$2\frac{1}{4}$	108	5	358
$1\frac{1}{4}$	38	$2\frac{1}{2}$	126	$5\frac{1}{2}$	413
$1\frac{1}{4}$	45	$2\frac{3}{4}$	146	6	470
$1\frac{3}{8}$	51	3	166	$6\frac{1}{2}$	531
$1\frac{1}{2}$	58	$3\frac{1}{4}$	187	7	593

For example, suppose the width of the notch is $4\frac{1}{2}$ ft. and the depth of water passing over the peg be $1\frac{3}{4}$ in., the Table shows that there is a discharge of 74 gal. per minute for each foot of width, which, when multiplied by $4\frac{1}{2}$, equals a discharge of 333 gal. per minute, or 19,980 gal. per hour.

Permanent and Portable Systems

If it is assumed that the water supply is adequate, then the distance from the source of the water supply to the point where the sprinklers, or spray-line systems are to be used must be measured and any rises or falls of the gradient noted. From the details so far obtained, the capacity of the pumping unit, if a pumping unit is to be used, and the diameter of the mains can be calculated.

Irrigation systems can consist of one or more entirely portable sets of equipment, including a portable pumping unit, portable mains and spray lines, or sprinklers, whereas others, particularly when the area is a small intensively cultivated piece of ground, are designed to eliminate moving time to the maximum and the mains are fixed throughout and quite frequently laid below ground. In the majority of cases, however, a combination of fixed and portable mains is the most economical and efficient method. Figs. 3 and 4 show clearly in diagram form a system with permanent mains and a system with portable mains.

When mains are laid below ground, they should be put down about 2 ft. in depth as a safeguard against damage by heavy lorries passing over them and in some countries as a protection against frost damage. If the pipes on the other hand are laid above ground, then they should be supported at the joints by wood or concrete stands. Arrangements for drainage should be made in all cases.

There are a number of different types of permanent mains suitable for irrigation installations—cast iron or galvanised steel are commonly used, although the asbestos-cement pressure pipes proved an efficient substitute during the period after the war, when materials were in short supply, and they are now used to a great extent in Great Britain for irrigation installations, owing to the lower cost of the larger sizes and the fact that they do not corrode.

Portable mains

Portable mains are usually made of either galvanised steel, or light aluminium alloy, preferably the latter. The aluminium portable mains have the advantage of being very light in weight and are easily portable. The most important part of the portable main to study, before purchase, is the ' quick-acting ' coupling. It is on this part of the portable main that ease of moving and general efficiency depend. Broadly speaking, portable main quick-acting couplings can be divided into two groups, namely those that are joined together by claws or clamps and those that are sealed by the force of the water pressure flowing through them. The latter type have the disadvantage that when the water is first turned on, large quantities run out at the connections until the pressure is sufficiently built up to seal the joint. The same thing happens when the water is turned off, or the pump is stopped. Water in some countries is a commodity that is expensive and unnecessary losses should be avoided on this account. In any case, uniform watering is not possible when flooding takes place in large patches of the field.

The planning of an efficient irrigation system is one for the experts and if the scheme is properly designed, much time and money can be saved by the user. Every individual scheme has its individual problems. There are, generally, several alternative methods of dealing with these problems and long experience in the very specialised trade of irrigation-equipment manufacture is of great value when studying the conditions and requirements, before planning a system, which, after all, once it is installed should last a lifetime. The best procedure then is to discuss individual irrigation problems with the better - known irrigation specialists and follow closely their recommendations.

Problems of Reclaiming Certain Infertile Areas in the Sudan Zone of Northern Nigeria (Kano Province)

Continued from page 133

(1). *Pasture Establishment*

The operations which are described below, and which give a very fair chance of success, can be suggested as the best-known method so far for laying down an improved pasture:

(*a*) Subsoil only where there is a definite surface pan.

(*b*) Disk plough or Marden Brush Cut the area and erect anti-erosion bunds where necessary.

(*c*) Encourage the local people to remove any shrubs that are lying on the surface for firewood and bedding.

(*d*) Commence fencing the area.

(*e*) Distribute superphosphate on the area at a rate of 4 cwt. or more per acre.

(*f*) Disk harrow.

(*g*) Plant the seed immediately, preferably just after disk harrowing and just before rain. This operation should be timed to occur at the end of June in the Kano area.

The seed rate should be at least 20 lb. of seed chaff per acre where Kyasuwa or Gamba is being sown although it would be better if an even higher seed rate could be adopted. One of the problems of this area is that there are no facilities for thrashing grass seed which means that the exact amount of seed sown, as opposed to chaff, is always questionable.

(*h*) After-sowing treatment is of doubtful value but spiked harrowing, chain harrowing or brushing might be of use in certain circumstances.

(*i*) No grazing should be allowed in the year that the grass is sown unless the take is very good. In this case a limited amount of grazing could be permitted in the case of Kyasuwa after the grass has set seed.

(2). *Crops*

Where it is intended to grow crops on these areas it is necessary to destroy the shrubs and cultivate the land, either by hand or machine. Superphosphate should be distributed at the rate of approximately 3 cwt. per acre for groundnuts and slightly more than this amount for guinea corn. The seed should then be sown and the crop treated in the normal way.

A rotary chopper which has a two-bladed knife suspended horizontally four or five inches above the ground. Rotated at high speed by the diesel engine mounted on the chopper, the blade chops up all growth it comes in contact with. It is used to do some clearing of small growth and to control regrowth on cleared areas. It is shown being powered by a Caterpillar D318 Diesel Engine and pulled by a Caterpillar D7 Tractor

ADVANCED DESIGNS IN LAND-CLEARING EQUIPMENT

So varied are the conditions found on land-clearing jobs throughout the world that most successful clearing contractors and machinery men know they must personally see each new site to be cleared if they are asked to make accurate clearing machinery recommendations. Some of the conditions they have learned to look for are: type of soil, its condition, the climate, type and size of growth, general lay of the terrain and end use of the land after it is cleared. They know that each of these conditions has a bearing upon machine selection, and that machine selection may vary as the conditions change on any one job if clearing is to be carried out effectively and economically. This article was prepared by the technical staff of Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

LAND clearing today is being carried out by governments, land-clearing contractors, general contractors and by farmers themselves, the last two groups doing it more or less in their slack seasons. These are the machines they are using and the conditions under which they are using them:

If small growth (that not thought of as trees) is being removed, the machine being used depends mostly on the type of growth. If it is the type that will propagate from any piece of root or branch remaining in the soil, a machine is used which cuts the roots beneath the surface below the point where they would send up a new shoot, leaving the 'plant' standing in the soil to die.

Root cutters

There are several machines which can be used to do this type of clearing. Called root cutters, they are designed as V-shaped blades. They differ in design according to the different types and sizes of growth to be removed and the different kinds and sizes of power units they are used with.

If the growth is small, root cutters may be mounted to the circle of a motor grader. For large material, the sweeps are usually attached to a tool bar mounted upon, or pulled behind, a track-type tractor. Rolling coulters are often used with them to prevent material dragging up on the root-cutter shank and to reduce the amount of grass torn up as the root cutters are pulled through the soil.

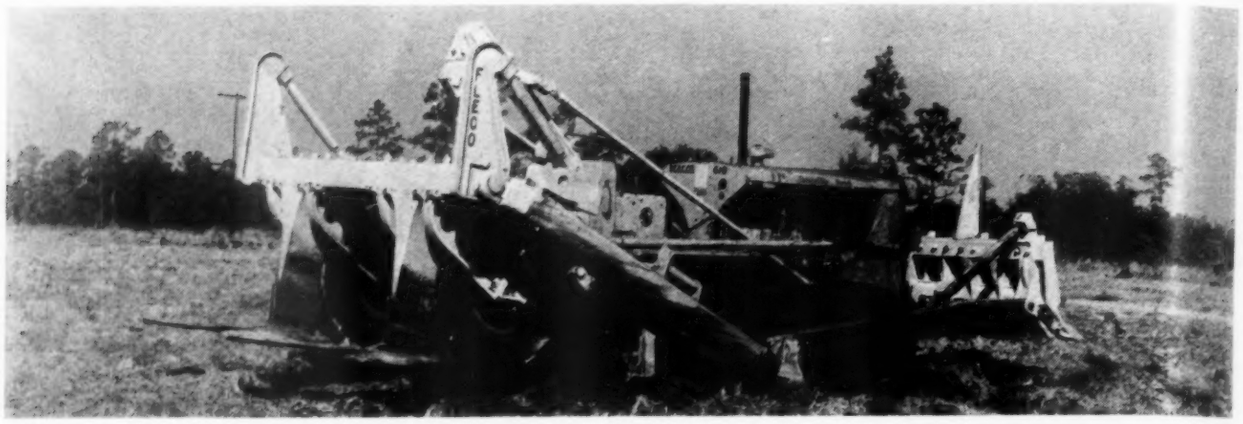
If the land is to be set to pasture, oftentimes the growth killed with a root cutter is left to decompose as natural grasses grow back. If, however, the land is to be planted to crops, it often is desirable to remove the killed growth instead of working it into the soil after the growth has died. In that case, it is raked and burned.

If such small growth is not the type that will propagate from small pieces remaining in the soil, there is a machine being used that cuts the roots beneath the surface and chops up surface growth and works it into the soil in one operation. It is called an under-cutter and it reduces the cost of clearing if the growth does not have to be raked and removed before the seedbed is prepared.

If there is sod on a plot to be cleared, and that sod is no longer needed, rakes are sometimes used to remove both surface growth and roots. The teeth are equipped with special shoes so that even the smallest roots are removed from the soil to the depth the rake penetrates.

In dry areas, root cutters are used if sod is to be left on land being cleared. They disturb it very little; this is desirable since sod is difficult to get started in dry areas. Perhaps the only disadvantage of root cutters is that they cannot be used in frozen ground.

When clearing involves the removal of trees, the type of machine being used depends upon the use to be made



If brush or shrubs are of the type that will not propagate from any piece of root or branch remaining in the soil a machine is used which cuts the roots beneath the surface below the point where they would send up a new shoot. The plant is then left standing in the soil to die. The machines for this purpose, called root cutters, are designed as V-shaped blades. Here a Caterpillar D8 Tractor is shown equipped with a Fleco RC8 Root Cutter and a Fleco Rock Rake

of the land, and, of course, the size, type (hardwood or softwood), density and root system of the trees.

Tree cutters

If they are being cut off at the surface, the choice of the machine being used depends primarily upon size of the trees. If they are up to eight to ten inches in diameter, a tool called the Crossville Treecutter is sometimes used on track-type tractors with a drawbar horsepower of 90 or more.

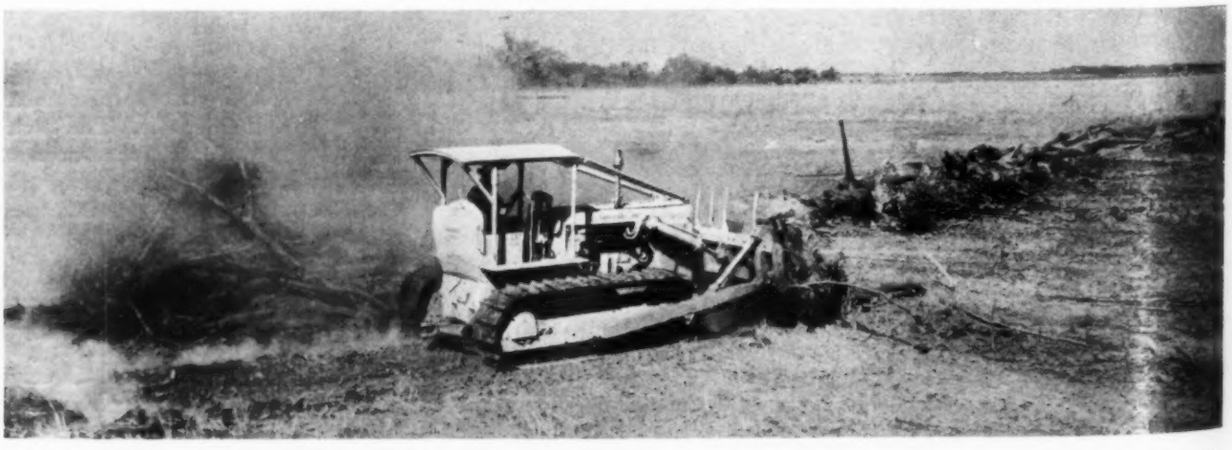
This machine resembles a V-type snowplow. On the top of the point of the V however, a snout about four or five feet long is attached, which protrudes ahead of the tractor much like a battering ram. Scalloped edges are fastened along the bottom edges of the V.

This machine works best where there is a heavy population of trees.

Driving the tractor at two or three miles per hour, an operator may move through the trees, cutting them off as the scalloped edges of the blade come in contact with the trees.

This tree cutter is usually run on top of the ground. Of considerable weight, it would place too much strain on the cable control and front idler and rollers if it were operated off the ground. It is not usually run beneath the surface either because too much horsepower would be needed to move it through the soil.

In removing a tree with a regular bulldozer blade, the operator first makes several cuts around the base of the tree to sever some of the tree's lateral roots. Then a ramp is built on one side of the tree in order to obtain better leverage. Here (left) *a Caterpillar D7 Tractor is being used in the state of Alabama, U.S.A.*



Stumps remaining after cleared growth has been stacked and burned are being moved off the land with a root rake. If any soil is picked up as the stumps are moved, it can work through the rake teeth instead of being placed in a pile to hinder further burning. This cleaning up follows land clearing on land in the state of Texas, U.S.A. The rake is being used with a Caterpillar D6 Tractor.

The Crossville Treecutter can be used on larger trees, too, although they may be removed more economically with other machines in some cases. The operator makes a cut on each side of the tree and then raises the tree-cutter in the air and puts the snout against the tree trunk high off the ground.

This gives excellent leverage, which is needed to knock a tree over if the trunk has been partially severed. This, of course, depends upon the size of the tree, whether it is hardwood or softwood, and many other variable factors.

Some of these variables include: skill and experience of the operator; condition of the soil, which determines how much traction can be obtained and whether the tractor will mire down; whether the terrain permits the operator ' to get up speed ' before cutting into the tree; and size of equipment being used, etc.

Another such machine, but designed for removing larger trees, is the Fleco Treecutter. It is similar in appearance to a bulldozer blade but it has several features a 'dozer blade does not have.

At the top, a tension bar is mounted, which comes in contact with the tree before the main part of the blade does. This bar pushes the tree away from the tractor, stretching the tree fibres on the tractor side so they are easier to cut.

At the bottom of the blade, a special cutting edge is mounted at a 90° angle to the main blade. This special cutting edge cuts the tree off as the tractor continues its forward motion after the tree cutter contacts the tree.

The Fleco Treecutter is used to cut trees up to 20 in. in diameter. However, to be used most economically, this machine should be limited to trees that are approximately 12 in. in diameter. With this type of growth, the tractor can be operated in a higher gear

A treedozer being used to clear land in Lampung, South Sumatra, Indonesia, where the Government is clearing 7,500 acres of jungle. The boom pushes the tree away from the tractor and then the blade of the 'dozer digs into the base of the tree to lift it out of the ground. This treedozer is mounted on a Caterpillar D8 Tractor

A detachable stumper is being used to remove a pine stump in the state of Florida, U.S.A. It is fastened to the C-frame of an angling bulldozer blade. It is especially good for removing stumps because it permits all the power of the tractor to be concentrated in a 30-in.-wide area. It is shown mounted on a 'dozer frame on a Caterpillar D7 Tractor

and a much greater daily production can be attained.

With this treecutter mounted on the tractor, the operator drives through the area to be cleared, cutting off the trees as they come in contact with the blade. Forward motion is not stopped as the tractor cuts a swath while travelling between two to three miles per hour as conditions permit.

Trees are cut off flush with the ground with the Fleco Treecutter, too. Where stumps are not a problem, if they are flush with the ground, this type of clearing can be done very economically with equipment matched to the job conditions and handled by a competent operator.

These two tree cutters are used widely for dam, reservoir and power-line right-of-way clearing. They also find wide application in pastureland reclamation when the ground will not be worked up after it is cleared.

The terrain where they are used permits a good travelling speed of two to three miles per hour to be maintained. Without this speed, these tree-cutters do not get the shearing action as the blades strike the trees. The soil must be firm enough, too, so that the trees are held in place when the blades strike them.

High ball

Clearing of a similar nature is accomplished by pulling a length of anchor chain, varying in length from 200 to 500 ft., between two tractors or two teams of tractors. The U-shape chain pattern is pulled from the ends and knocks down the trees it comes in contact with as long as the tractors have sufficient power.

In some cases, another tractor equipped with a boom will follow the chain at its centre to raise the chain off the ground for better leverage on trees. On other jobs, a huge ball eight or ten feet in diameter is fastened through its centre and in the centre of the chain to keep it off the ground for a higher chain contact against the trees.

Treedozer

When land is cleared and the stumps are being removed as well as the top growth, different types of clearing equipment can be found in use. A specialized machine used in this type of clearing is the treedozer. Another machine used is the regular bulldozer blade which is more often thought of as an earthmoving tool.

The treedozer consists of a short V-shaped blade that is mounted on the tractor much like a regular bulldozer blade. Above it, and extending about three feet forward of the point of the blade, is a boom, which is mounted separately to the tractor and controlled independently of the dozer blade.

To remove a tree with this tool, the operator raises the boom above the blade and then moves against the tree. With the blade set at ground level, it contacts the trunk of the tree about the same time as the boom which operates five to ten feet from the ground.

After the boom has pushed the tree away from the tractor and the blade has been driven into the base of the tree, the operator raises the blade uprooting the tree. Depending on the size of the tree, two or more attempts may have to be made before it falls.

To remove a tree with a regular bulldozer blade, the operator usually must cut many of the lateral roots by digging the earth away from the base of the tree. Then, he must build a ramp so he can get his 'dozer up high enough to get sufficient leverage to force the tree over.

Specialised machines are usually used by land-clearing contractors but regular bulldozers are used by contractors and farmers who do clearing infrequently. In general, substantially higher production can be achieved by use of specialised clearing tools.

If the surface growth on a piece of land has already been cleared and the stumps are being removed so the ground can be tilled, there are several types of machines found on such jobs. In addition, the regular bulldozer blade also is used.

Stumpers

One machine, the detachable stumper, is fastened to the frame of an angling dozer. An operator lets the stumper run into the soil to a depth of about six inches just before it meets with a stump. Then, as the tractor continues to move forward, the operator raises the stumper and the stump is forced up and out of the ground.

This tool is especially suited for removing stumps of large trees which had a fibrous root system and not a long tap root. If a tree had a long tap root and enough time had elapsed for the root system to partially decompose, the detachable stumper could be used to remove these stumps also.

For larger stumps, a pull stumper, which fastens to the drawbar of the tractor, is available. Resembling a huge claw, this machine can be used to sever lateral roots attached to a stump by making a cut on either side before any attempt is made to remove it.

In use, the stumper is lowered behind a stump as the tractor moves forward in first or second gear. After contacting the stump and perhaps moving forward until the tracks slip, the operator raises the stumper with the cable control, lifting the stump out of the ground if enough roots have been cut, etc.

It is always best to remove stumps, if they are to be removed, at the time the rest of the tree is knocked over. They are much easier to remove with the tree still attached than after the upper part of the tree is gone. If the timber is to be logged for lumber, however, this procedure may not be practical.

Rakes

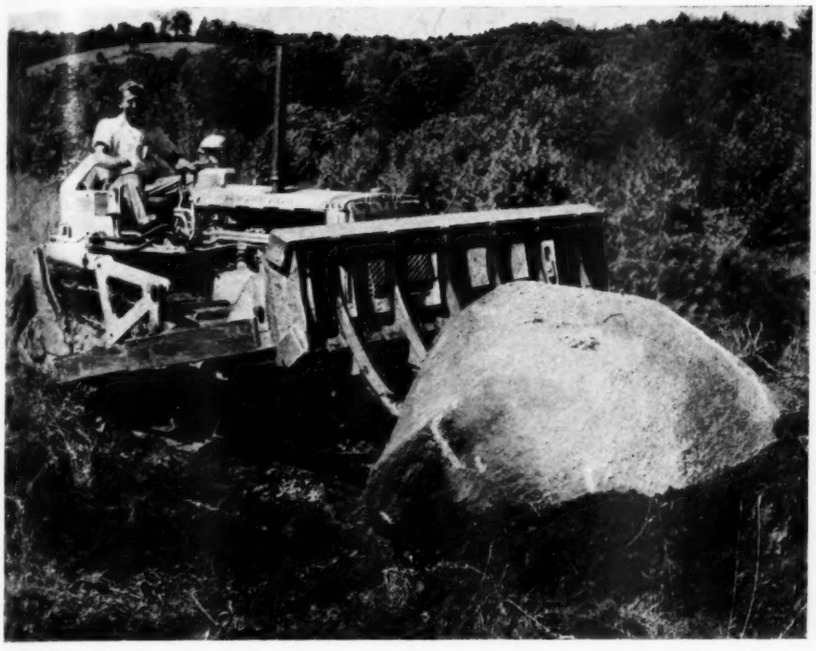
To remove trees and brush from land after they have been pushed out, there are a variety of rakes which can be fastened to bulldozer push arms. Built in varying degrees of strength, there are rakes available to handle the light growth through to the heaviest trees and even rocks and boulders.

The teeth of these rakes are spaced far enough apart to let any soil fall through that is picked up as brush and trees are pushed into windrows. Usually, an operator will shake the rake as he moves a load with it, shaking any soil out which may be clinging to roots etc.

The material burns much more thoroughly if it is clean, and valuable soil is not removed from the field.

If the land is to be used immediately the growth cleared must be raked and burned or disposed of in another way. In some cases, the material may be buried.

If there is no immediate need to place the land in production, raking it will depend upon such factors as: will the cleared growth burn?; how much soil is in the roots?; the cost of raking



Land clearing sometimes involves the removal of rocks and boulders as well as brush and trees. Here a huge boulder is being removed from pasture in the state of Vermont, U.S.A. The work is being done with a Caterpillar D4 Tractor equipped with a Fleco Rock Rake

and stacking the material and burning it; and the value of the land, since it may be so valuable that no space can be allowed for material to be windrowed and dried until it can be burned.

Various attachments are available to increase the versatility of the rakes. Top guards can be added to enable an operator to push higher piles of loose material. Shoes can be added to the rake teeth through which small roots and other material would slip if the shoes were not used.

There is no one machine that can undertake all phases of clearing. Frequently, on large clearing jobs, tractors will be equipped with different clearing equipment and the operators will work in teams, with each operator doing the work his tractor is best equipped to perform.

Cutters and choppers

Frequently there will be some regrowth on a piece of land after it is cleared. A machine recently developed to control this growth economically is the rotary cutter. It has a blade mounted horizontally several inches off the ground and this revolves at high speed as the machine is pulled over the field, removing any growth in its path.

Another machine designed to control regrowth, and which will also clear small growth, is a rolling chopper. In appearance it resembles a large drum-type roller. Fastened to the perimeter of the drum, however, are many knives three to four inches high which cut up the growth as the chopper is pulled over it. It is used quite widely to keep pipeline and telephone rights-of-way clear.

Chemical clearing

Clearing with chemicals has been carried out to some extent in the past ten years. This type of clearing, however, is being done today mainly to control secondary growth.

It has proved to be too expensive in many cases if used to clear primary growth. It has also proved to be impractical where growth is scattered. It has also resulted in lawsuits when the chemical was blown on adjoining fields, damaging crops, livestock and buildings.

Offset disk harrow

On land being cleared for pasture with the trees and brush being cut off even with the surface or just beneath it, a machine used to work the soil down, if a form of seedbed is needed, is a heavy offset disk harrow.

The first time the disk is used on the land for root and branch cutting, it should be set with very little angle and sometimes added weight. It should be run over the soil in order to chop up branches of roots lying on or near the surface. If it is given too much angle, a blade might be broken as the disk is run over a stump.

If there are any dead trees on the clearing site, extreme care is exercised when they are removed. If they are jarred with the tractor, dry, dead limbs may be knocked off to fall on the tractor and injure the operator. Tractors used in clearing work should always be equipped with cab guards to protect operators from such hazards.

As land clearing continues to be done throughout the world, new machines will continue to be developed to do the work more efficiently and economically.

Until they are, however, a thorough knowledge of existing machines and the conditions under which they can best be used will ensure that they are used to clear land most efficiently and economically.

Experience of land clearing contractors and the men who manufacture the machines to do the work all agree that ' With the right equipment, the job can be done for less '.

Photos: p. 138 (top) Fleco Corpn.; all others by Caterpillar.

TECHNICAL NEWS

The contents of *Building Materials* for April will contain articles on ' The Architectural Use of Building Materials ', by Edward D. Mills, F.R.I.B.A., ' Developments in the Application of Concrete to Housing ' and ' New Materials for Brick-making '.

Among articles appearing in the April issue of *Chemical & Process Engineering* is ' The Atomisation and Spraying of Liquids in Industry '.

The April issue of *Food Manufacture* includes articles on ' The Dairy Industry ', by A. W. Marsden, M.SC., F.R.I.C., ' Nutrition ', by Dr. Francis Aylward, and ' "Synthetic" Foods—Indian Research '.

Manufacturing Chemist for April will include articles on ' Solubilisation with Amphiphilic Compounds—II ', by P. A. Winsor, PH.D., D.SC., and ' Fertilisers and Plant Nutrients ', by D. P. Hopkins, B.SC., F.R.I.C.

A VR.180, equipped with a scraper, being used to build up a working road alongside the canal

VR.180 Tractors Helping to Speed Food Production in the East

There are now many Vickers VR. 180 tractors operating in Pakistan, Ceylon, Malaya, Singapore and British North Borneo, helping to carry out a number of development programmes.

Land clearing for food production is high on the list of operations, where the VR.180's earth-moving efficiency is being used to advantage.

Malayan example

A typical example is an irrigation scheme approximately 16 miles inside the Malayan jungle. Here two VR. 180s are being used on jungle clearing and assisting in cutting a canal in the Slim River area. This canal will join the waters of the Sungei Tengi River and the Bernam River, thereby supplementing the waters of the Sungei Tengi with those of the Bernam River, through the canal and its respective headworks. The irrigation waters are required for the padi fields of the Tanjong Karang area through which the Sungei Tengi flows. The machines are owned by the Drainage and Irrigation Department of the Federation of Malaya, who are responsible for the scheme.

Canal building

The accompanying illustration shows one of the VR.180s, equipped with a scraper, being used to build up a working road alongside the canal. The tractor's high operating speeds increase output on this type of work by reducing haul times from the digging area to the dumping point. The material being handled is chiefly clay with a proportion of peat and rotting vegetation, the road itself being laid over swampy ground.

The tractor is powered by a Rolls-Royce supercharged oil engine, designed to meet the exacting operating conditions found in tropical climates. Matched earth-moving equipment available for use with the VR.180 includes hydraulic and cable-operated 'dozers, onions scrapers, rippers, root cutters, towing winch and logging arch.

Rollers

Onions sheepsfoot and rubber-tyred compaction rollers are produced for dam construction or communication road building once the initial land clearing has been completed.

This wide range of equipment is now being used in many Commonwealth and other countries where food production is being stepped up.

Soviet Tractors for India

The Soviet Government is understood to have proposed a gift of agricultural machinery to the Government of India to organise a State farm.

The gift will include 72 tractors, 60 harvesters, and over 500 other agricultural equipment items capable of running a farm of 15,000 acres.

Output Doubled Since 1938

Southern Rhodesia's agricultural industry has more than kept pace with the increase in the country's population since 1938. In 1954 the volume of agricultural output was more than double what it was in 1938, according to figures published by the Central African Statistical Office. During the same period the value of agricultural products has risen tenfold. In 1938 it was £3,770,000 and in 1954 it was £37,610,000. This increase was largely due to the expansion of the tobacco industry. The value of tobacco produced has risen from just over £1 million to more than £19 million. Cattle slaughterings have increased from £832,000 to £5,050,000, maize from £621,000 to £5,420,000 and dairy produce from £199,000 to £1,315,000 in the same period. Manufacturing industries have increased even more during the 16-year period than agriculture. Output in 1954 was over four-and-a-half times as much as in 1938.

New Fertiliser Reduces Costs

A new company has been formed to market a new type of fertiliser, Sustanum, which has been under test for some years. The manufacture of the new fertiliser requires the use of processes devised by a Danish agricultural scientist (E. L. Schioler), and patent applications have been made.

The main process consists in embedding the fertiliser chemicals in a special carrier material, which allows the gradual surrender of the major nutrients and trace elements to plants over a long period. The manufacturers claim that the majority of trace elements are normally turned into compounds which are unavailable to plants growing in a soil with a certain alkalinity; but most soils have have been brought to this stage by liming. To counteract this difficulty the carrier material in which Sustanum is embedded is rendered sufficiently acid to act as a buffer against alkalinity and so prevents the 'locking up' of the essential chemicals.

The new product will be marketed by Trace Element Fertilisers Ltd., 72 Victoria Road, Surbiton, Surrey.

Progress in the French Wine-growing Industry

PROF. J BRANAS

(*Ecole Nationale d'Agriculture de Montpellier, Hérault, France*)

Prof. Branas was born at Moulis-Médoc, Hérault, France, in 1905 and has devoted most of his life to the study of wines and wine-growing. He studied under Prof. Louis Ravaz and, after teaching at the Ecole Nationale d'Agriculture de Montpellier for some years, he was offered the Chair of Viticulture at that institution in 1932. Prof. Branas is a distinguished author and during the war he held the rank of Captain in the Reserves. He is a member of several French and Italian agricultural societies and an Officer of the Legion of Honour.

THROUGHOUT the greater part of the French territories conditions are favourable for the cultivation of many hundreds of varieties of vines, stemming for the most part from indigenous flora.

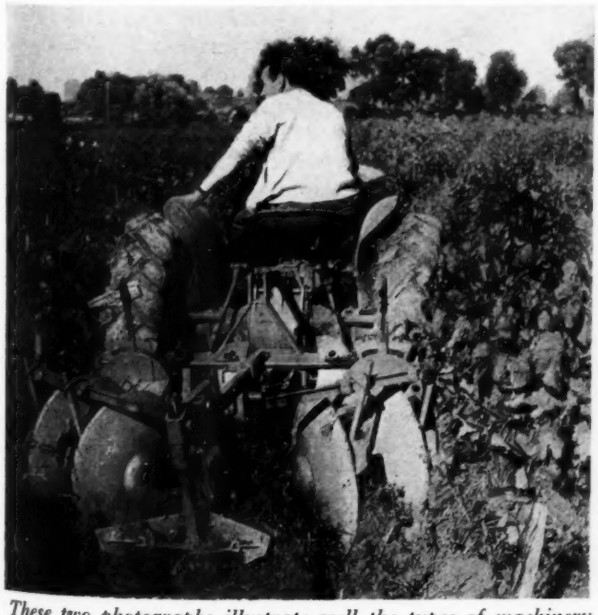
More than 1,500,000 ha. on the French mainland and about 400,000 ha. in Algeria are devoted to viticulture; a common market receives the the entire output from these areas, the production being, on average, 56 million hectolitres (hl.; 1 hl. = 22 gal.) per year in France and 17 million hl. in Algeria. Some wine is imported from other territories (Tunisia, 1,500,000 hl.; Morocco 1,200,000) and a little from foreign countries. The total annual production, which exceeds 76 million hl., makes viticulture the fourth major plant-cultivating industry in Metropolitan France; in Algeria it takes first place.

Consumption

The demand in this market is very high. Consumption, controlled by the administrative services, reaches 62 million hl., more than 3 million hl. are exported and approximately 3 million hl. are used for making eau-de-vie, vermouth etc.

Yields regularly exceed demand and prices paid to producers would collapse if the surplus was not absorbed in the ancillary industry, alcohol production. The financial effect of this state of affairs is so bad that the Government votes millions of francs to subsidise this industry. Although these subsidies do not exceed those that are allotted to other branches of agriculture it is intolerable that the vine-growing industry should be a burden on the nation and that they lead to the production of excess alcohol. The country is not short of this product and the recompense is poor. The heavy taxes levied on wine, the maintenance of numerous workers and the prosperity of related industries do very little to ease the situation. This state of affairs seems extraordinary to observers from other countries and it is quite incomprehensible to those to whom the growing of vines and the consumption of wine is of little social and economic importance.

The reasons for the lack of balance between supply and demand in the



These two photographs illustrate well the types of machinery that is being used on progressive vineyards in France. Implements of this nature, together with efficient cultivation methods, are increasing grape yields in France.

French wine market are to be found in the policy of the growers. Viticulture is one of the branches of agriculture. In the eyes of producers it has only one objective—profit. Now if the selling price of wine is fixed by general economic laws (i.e. not influenced by the growers themselves), it is easy for the growers to increase output and cut the costs of production. The methods used are infallible: establishment of wine-growing in suitable soils; advanced methods of cultivation (' dressing ', fertilisation, irrigation); and the use of productive and hardy varieties, often created by crossing. The application of these methods is so efficacious that the average yield has been increased from 21.1 hl./ha. to 38.4 hl./ha. between 1860 and 1939.

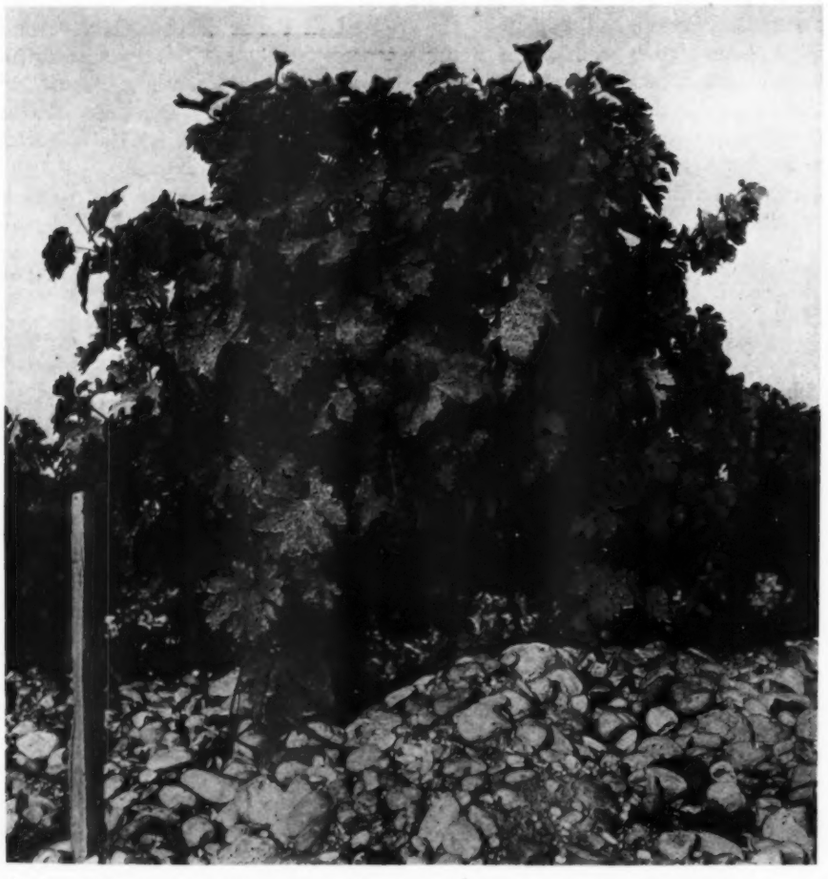
Economics

In doing this French vignerons have only obeyed universally adopted principles for improving agricultural production and they should not be reproached for using technical progress for their own ends.

The competition between regions (and between growers) is directed towards decreased production costs for a unit volume of wine of the same spirit content and also to prevent vine-growing on farms and in districts that are least likely to produce higher yields, as the expenses incurred by producing 100 hl. or 50 hl. from the same area are much the same. The reduction in supply brought about by the elimination of unfavourable areas will help to equalise the balance with demand.

This system does not lack advocates although in the long run a certain rigidity is given to production methods and this tends to complicate the matter. But French experience shows clearly just how much this perspective is false. It also shows the danger of applying to viticulture ideas that may be valuable for other agricultural products.

The grower's profit should not be the sole aim of viticulture; the real objective consists in satisfying the tastes and requirements of the consumer. The principal product, wine, relies on particular criteria.



A classic illustration of the soil in the wine-growing area of the Médoc (Bordeaux)

Wine is not indispensable to man and it is only consumed for gratification. It has hygienic and salutary effects when taken in moderation. Abuse is degrading and a craving for it ought to be combated as a vice. The usage of this beverage is only justified, morally and medically, when used in moderation and when taken for its beneficial effects.

Technical progress

Technical progress in viticulture should not have profit as its main objective. It must, in the first place, strive to produce better wines. The conditions for producing these wines are known: cultivated varieties, climates, soils, cultural and technological practices. These are not in accord with the generally progressive tendencies adopted in agriculture: yield and resistance to certain maladies are the criteria for the types actually cultivated.

A certain conflict of opinion exists between two schools, those whose prime object is a reduction in production costs and those whose aim is to produce wine which will satisfy the consumers requirements. Competition favours the progressive wine-grower. The traditional methods are likely to disappear altogether and this will be resented as a national loss because the best wines will disappear with it.

The objective of those who declare that consumption requirements and market equilibrium require the same methods is a systematic regulation of all production conditions (soils, varieties, cultural and technological practices), together with controlled marketing.

Legislative intervention has become a necessity. Similar conditions have arisen in other wine-growing countries but it is in France that it has assumed the most varied forms, if not the most effective. The French legislature has produced a ' Code du vin ', a large volume containing all that apertains to vines and wine. It is a complex document but most believe that it has not covered all the methods available for intervention by the authorities. However, it assists in progressively restraining the choices open to the producers; but the number of restraints weighs heavily on the producers and traders and they oppose them vigorously.

The methods of a traditional wine-grower: a yoke of oxen employed for transporting the grape harvest in Médoc (Bordeaux)

The improvement of the French wine-market situation thus rests on a definition of technical progress derived from consumption characteristics, to which production ought to adapt itself; the inverse does not occur.

Viticultural production is not, as we would wish to believe, an exception; but for it, more so than for other agricultural products, quality is of prime importance.

The future

More so than for any other product, technical progress, when viewed in the manner described above, opens illimitable prospects to the wine-growers and it will lead to stable and favourable conditions.

Photos: p. 143, Shell-Berre. Chadefaud; pp. 144, 145, Commanderie du Bontemps-de-Médoc.

Sugar-cane Technologists' Conference

The gathering of the delegates of the Ninth Congress of the International Society of Sugarcane Technologists in India during the period 4 January to 2 February, 1956 was an event of great significance. It was the first time that the international society had met in India, a country which at the present time is the world's largest sugar producer, and in which the sugar industry ranks second only to textiles. It coincided also with a projected further development in which the Indian government hopes to produce sufficient sugar to meet the immediate needs of its vast population.

Some 100 foreign delegates accompanied by Mr. D. R. Narang, General Chairman, T. Prasad, General Secretary-Treasurer, several members of the Congress organising committee and some 50 top-ranking Indian Technologists foregathered in Bombay on 4–5 January and commenced the tour of some 5,000 miles by special air-conditioned train, which was to give the delegates not only an excellent cross-section view of the vast area of 4 million acres on which sugar-cane is grown but also the opportunity of seeing the rich inheritance of Indian culture and history.

The extremes of conditions under which sugar-cane is grown from the rich, irrigated plains of the Deccan to the arid acres of Uttar Pradesh, the varietal contributions of the famous cane-breeding station at Coimbatore, the agronomic advances made in the provincial stations, and the interesting technological researches in progress at Kanpur and Lucknow attracted the particular attention of the foreign delegates and there was obvious approval at the initiative shown in the realm of secondary industries by Rohtas Industries Ltd. at Dalmianagar.

The first plenary session was held in the Central Hall of Parliament House in New Delhi on 25 January and sectional meetings of the technological sections were completed on 1 February.

On the agronomy side very useful discussions took place. The most likely developments in sugar-cane breeding were discussed, emphasis being placed on the importance of increasing variability in seedlings and the use of a far wider range of wild forms of *Saccharum spontaneum* and other wild species, which have recently been introduced into the Coimbatore collection. Sugar-cane diseases—some of which are a matter of grave concern in India at the present time—were discussed in some detail particularly red-rot, of which about five distinct strains of varying virulence have been isolated. Two new diseases, which overseas delegates had not previously encountered — known for the present as twisted top and grassy shoot disease —were also discussed; they are apparently virus in nature. The mineral nutrition of sugar-cane, the factors affecting cane quality and a symposium on possible methods of basing cane prices on quality were other highlights of the congress on the agronomic side.

On the manufacturing side progress was recorded in the improvement of methods of analysis and factory reporting and some interesting developments in ion-exchange and electrical methods of juice clarification were presented. On the subject of sugar engineering the improvement of milling efficiency was discussed in some detail.

The Congress was an unqualified success and in addition to its concrete achievements it will undoubtedly do much to forge new links of co-operation and understanding amongst the sugar scientists of the world.

At the concluding plenary session an invitation to hold the Tenth Congress in the Territory of Hawaii in 1959 was unanimously accepted.

H. EVANS, PH.D., B.SC.

Rice Moves Northward

FRANTIŠEK KRATOCHVIL

Special attention is being paid to the acclimatisation of important crops in Czechoslovakia and, thanks to experimentation, it is now possible to start cultivation on a wide scale. One of these crops is rice, which is becoming increasingly important on the agricultural co-operative and State farms both in Slovakia and Moravia, where very successful results have been achieved; for instance, in Znojmo, Hrušovany and Jevišovkou, Dyjakovice and Hodonice.

THE area devoted to the cultivation of rice in Czechoslovakia is already considerably greater than in 1948. In Slovakia and Moravia the decisive factor is the minimum temperatures necessary for the various stages of growth of the rice. In germination the temperature required is 10–13° C., for the first shoots 14° C., for the period of flowering 14° C., and for that of drying 13–14° C. In South Slovakia and South Moravia the air temperature is above the minimum required for the various stages of growth. The vegetational heat constant, which averages between 2,500° and 4,000° C., comes to 2,600° C. in the case of the Dungan-Shaly variety of rice, according to Gyulay's estimate. The heat constant for Hurbanov, in Slovakia, is 2,800° C., which means that conditions are suitable there for the cultivation of various types of early rice.

The co-operative and State farms have succeeded in pushing the limits of rice cultivation northwards. Cultivation was begun at Kolarov, in the Komarno district, in 1948, when the first rice farm, covering 25 acres, was planted with Dungan-Shaly (*Oryza sativa* var. *zeravschanica Brsch*), a native of Northern China, which has been cultivated very successfully in Hungary. Its period of growth is 125–135 days. It has fine, sturdy shoots, a light appearance during growth, and a medium-sized grain, light brown in colour.

In Slovakia and Moravia the average sowing is 40 kg./acre. A good yield is 32 quintals to the acre; this was achieved in some parts of the Kolarov rice farm. An average yield is 12–20 quintals per acre. The other main type cultivated in Slovakia and Moravia is a Soviet variety, Kendzo (var. *dichroa Bat.*), which originally also comes from Northern China. This variety, which is 5–10 days earlier than Dungan-Shaly, is planted at the end of April or the beginning of May and in larger quantities than Dungan-Shaly. The yield achieved at Mikulcice, in the Hodonin district, was 16 quintals per acre. Apart from this, experiments in acclimatisation have been made with Maratelli, Poerro, Kyrmyzy, Krestoska and Pierot varieties.

Irrigation

The Slovak and Moravian farms have concentrated in particular on varieties with a period of growth of 120 days. This has been done successfully in all areas where the average temperature in the period of growth reaches about 20° C.

As is known, rice cultivation requires enormous quantities of water—8,000–10,000 cu. m. per acre on average—during the period of growth, the quantity varying according to the variety, the soil and the irrigation system used. The farmers at Hodonice have found fresh water rich in oxygen to be best, and thus irrigation is for the most part carried out with water from rivers and streams coming from some distance away. Rich, clay soils, such as occur in river valleys, are favoured sites, and experience gained, particularly in the areas flooded by the River Bodrog, has shown that areas formerly used as pasture, meadowland and drained marshland are excellent for rice cultivation, providing there is no peat in the soil. The ideal is a depth of soil of 1 ft. to 1 ft. 8 in. and impermeable substrata. As far as chemical reaction is concerned, rice requires a neutral soil or only slight acidity.

Cultivation

Much attention is paid to the question of rotation on the Slovak and Moravian rice farms, with clover in the fourth year and hemp, or some other industrial crop, in the final year. The growers have found that if the fields are continuously irrigated without the correct rotation of crops they become insufficiently 'aired'. Correct rotation is also of considerable assistance against diseases to which rice is susceptible,

The ground is thoroughly levelled and then the dikes are constructed to contain the water

Co-operative farmworkers at Kolarov (south-west Slovakia, near the Hungarian frontier) preparing a new rice field with the help of modern machinery

other destructive agents and weeds.

Basic ploughing is carried out as a rule in the autumn, down to a depth of 9 or 10 in., and the land is left untouched during the winter. Experience has shown that rice gives a better harvest after autumn ploughing than after spring. In the spring, as soon as the ground is free of frost, it is harrowed; but where weeds have grown further ploughing to a depth of 5 in. is carried out, followed by the harrowing. The soil is smoothed over again, lightly rolled, and after mechanised sowing it is flooded with water 10–16 in. deep. Since rice requires the soil to be at its richest in the period after it has put out its first shoots, manure is applied, so far as possible, at regular intervals. Experiments conducted with manure from hops—16 tons to the acre—have led to yields up to three times as great as those in areas that have not been manured in this manner.

Yields

In general, what have been the results of cultivation? From 1950 to 1954 yields have varied between 8 and 30 quintals per acre. In some rice fields a yield of up to 40 quintals per acre has been achieved.

Considerable successes have been achieved also with subsidiary products. It has been found possible, for instance, to obtain from 60–72 kg. of fish per acre. At Mytne Ludany 120 carp (per acre) weighing 300–400 g. have been introduced and have doubled their weight by the time the rice ripens. Certain growers have introduced ducks into the rice fields in the period between early shoots and full growth; the ducks keep down all kinds of weeds. In addition to this, growers have recently started cultivating various vegetables on the dikes, in particular cabbage, red pepper, tomatoes and celery, all with excellent results.

During the few years in which they have been engaged on this work the farmers of Slovakia and Moravia have made satisfying progress. The further cultivation of rice in Czechoslovakia will be integrated with plans for the changing nature in the warm regions of the country, and it will be co-ordinated with developments in the overall plan for agricultural advances, which will result also in a much more economic use of available water resources.

Yellowing of Maize in South Africa

According to a statement issued by the Director of the Potchefstroom College of Agriculture, a condition affecting maize, called ' yellowing ', has spread over a much larger area of South Africa than was the case last year.

The condition is easily identified by the sudden development of longitudinal yellow streaks in the leaves of young plants. Although the plants may recover the yield will probably be much smaller. In some cases, however, they may be affected to such an extent that the yield is a total failure.

The yellowing is mainly encountered on sandy soils that have for many years been cropped intensively without the necessary precautions being taken to balance the farming system as a whole. Injudicious application of mineral fertilisers can aggravate the condition, but it is not infectious. All maize varieties are equally susceptible.

The statement warns farmers that no fertilisers should be used on effected fields other than straight phosphatic fertilisers, such as superphosphates and basic slag, except on specific advice following an analysis of the soil.

Spanish Tractor Production

There is great activity in Spain in the production of motor cars, tractors and trucks. The government-sponsored Enasa company—makers of ' Pegaso ' vehicles—are preparing to make tractors in their new Madrid factory soon, and German Lanz tractors are to be built in a factory now being constructed in Madrid.

In its Barcelona plant, Enasa is turning out about 800 heavy Pegaso trucks annually, including a tractor type for container-trucks.

The great demand for trucks, cars, motorcycles and tractors, which Spain lacks the foreign currency to satisfy from abroad, ensures a market for all home production for the immediate future. Agricultural experts, for instance, calculate that Spain needs a further 30,000 tractors to add to the 14,000 operating at present.

Many farmers in the U.S.A. use aircraft to spray poisons on fields and orchards to control crop-destroying insects. Most effective over large acreages, the aircraft method is valuable when the ground is too wet for surface vehicles and when rapid coverage is necessary to save crops during emergencies

Farming from the Air—American Experience

E. FORD

One of the most important current developments in agriculture is the increasing application of aircraft, particularly in the U.S.A., where it has contributed considerably to agricultural production in recent years. It therefore follows that a study of American experience in this direction should be of interest to agriculturalists elsewhere, although it must be recognised that American conditions are in many ways more suitable for aerial operations than those obtaining in many other countries.

SINCE the pioneer plane dusted a Louisiana cotton field back in 1917, the number of aircraft employed in agriculture has grown in the U.S.A. until the present day when, according to the latest figures available, some 7,000 planes and 2,000 air companies are engaged in agricultural aviation. These planes flew a total of upwards of 50,000 hours last year, distributing dusts, sprays, seeds and fertilisers.

Most of these companies are small concerns, with the head of the company often doubling the position of chief pilot. As a general rule, air companies engaged in agricultural work are specialised concerns; only rarely do general air-transport companies engage in agricultural work as a subsidiary activity. American experience has revealed that there is considerable scope for co-operative methods in the establishment and operation of agricultural aviation units. As an example of such a co-operative may be quoted the Polk County Dusting Co-operative at Dallas, Oregon, which was set up by a group of pea and vetch farmers to control an extremely dangerous pest which attacks these two crops.

Spraying

Most important of the uses to which aircraft are devoted in agricultural work in the U.S.A. is the control of pests and diseases, which accounted for about 55% of total agricultural flying hours in 1954. Although both dusting and spraying methods are still employed, spraying is today the more common of the two procedures. In general, dusting, which was formerly the only way of applying pesticides and insecticides from the air, is now only employed for such purposes as penetrating dense foliage.

Spraying has assumed this ascendancy mainly on the grounds of economy of load. [For example, whereas 20 lb. of dust per acre are required for satisfactory control of grasshoppers, the same end can be attained by the application of no more than half a gallon of aldrin spray (equals $3\frac{1}{2}$ lb.) per acre]. Moreover, spray materials are easier to handle and transport, and they also adhere more readily to leaves and are not so easily dispersed by winds and thermal currents.

What are described as 'chewing insects', such as caterpillars and beetles, are normally attacked with DDT, BHC, toxaphene, dieldrin, aldrin and methoxychlor. Grasshoppers, locusts and crickets are frequently controlled in the U.S.A. by baiting from the air with a wheat bran, poisoned by impregnation with a kerosene solution of aldrin, chlordane or toxaphene.

For sucking insects and spider mites, organic phosphates such as parathion, metacide, HETP, TEPP and Systox are used, but DDT is preferred for mosquitoes. This is frequently applied in granular form when attacking mosquito larvae under dense vegetation where liquid would be caught on the leaves and fail to penetrate.

Spraying from the air has proved particularly successful in preventing pre-harvest fruit-drop, experiments having shown that 2,4-D, as the sodium salt, is equally effective on apples, pears and grapefruit. Defoliants have also been applied from the air on crops of cotton, soya beans and potatoes. It is also considered that the aerial application of weedkillers has important possibilities. 2,4-D in amine or ester form is generally used for weed control

in cereals, and esters of 2,4,5-T are employed for resistant species of brush.

Fertilisers

About 35% of all flying hours in agricultural aviation are devoted to seeding and fertilising, the latter operation in particular having increased in recent years. Fertilisers may be applied either in granular or liquid form and this method of distribution is particularly useful in areas that are difficult to reach or to work with ground equipment. Similar considerations apply in the case of seeding operations, which can be done advantageously from the air over rice paddies, on mountain slopes and on range-land.

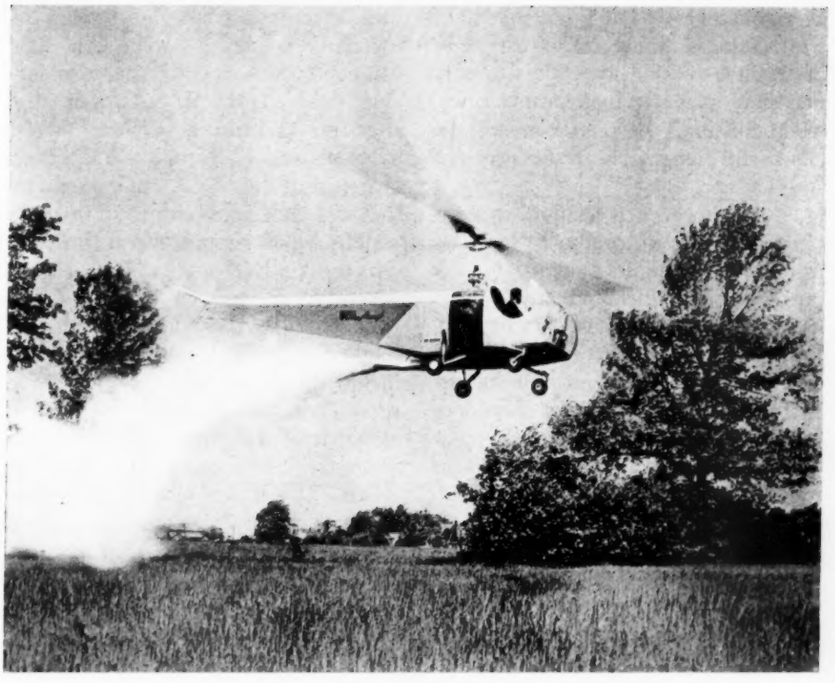
Survey, photography and other miscellaneous services account for the remaining 10% of flying hours devoted to agricultural aviation. Aircraft have been successfully used in range management, in fire patrols and in detection of soil types from the air. Aeroplanes and helicopters have also been employed to protect orchards and tomato fields from frost by stirring the air with the downwash from the machine.

New-type aircraft

Until recently, almost all the aircraft in use in agriculture in the U.S.A. were ordinary trainers, small transport planes or airliners converted for this purpose. Special designs for agricultural use such as the Rawdon T-1 and the Ag-1 are now coming into production in the U.S.A., however. The T-1 is described as the crop-sprayer version of a fully acrobatic two-seater with a low, braced wing. With its nozzles protruding below the wing surface, its excellent field of view and wide track, this aircraft is particularly suitable for spraying purposes. The Ag-1, which was specifically designed for both dusting and spraying operations, is an all-metal, low-wing single-seater with spray tanks holding 150 gal.

Helicopters

For certain operations, helicopters are preferred and several models specially designed for agricultural use are currently in use in the U.S.A. In general, helicopters are employed where low speeds are required or for precision work such as seeding small areas. They score over fixed-wing aircraft in possessing greater manoeuvrability and an excellent field of view. Their main disadvantage is their high initial cost of construction and the need for skilled maintenance personnel.



The helicopter is a deadly weapon in the war against pests which plague the farmer and is an effective method of pollinating crops. Engaged in a crop-dusting demonstration this machine 'walks' around trees and other obstructions. The rotor-bladed action washes insecticide spray or dust down and under plants as well as on top of them

Equipment

With regard to the application equipment, it is obvious that the swath should be as wide as possible, with uniform droplets capable of variation in size as required. Liquids are applied by four main types of equipment, namely full-span booms with nozzles, rotating brushes or disks, exhaust-type equipment and vertical rings. Boom-type equipment is used when carrying out operations under varying conditions since by changing the nozzles and altering the rate of pumping many combinations of droplet size and delivery rate can be obtained. Rotating brushes are best used when spraying from a fair height as otherwise there is a concentration of sprayed material below each brush and distribution is poor. In the exhaust type of equipment, the chemical is fed into the venturi-like part of the engine exhaust pipe where it is broken up into very small droplets. This method has not been widely used; neither has the vertical ring type, which is comprised of a ring mounted below the wing at right angles to the line of flight. The chemical is fed into the hollow ring and discharged through small holes in the rear surface.

For aerial application of dusts and solids, the venturi type of equipment is largely used. By mounting it below the hopper, the material to be sprayed is sucked through a gate into an air-stream of increased velocity, whence it is spread over the swath with the help of guide vanes.

Administration

Much work has been done on the best methods of organising the administrative side of agricultural flying in the U.S.A. Before the plane takes off, it is necessary to prepare operation maps, acquire the materials, brief the crews and study the available meteorological information.

Once the aircraft is in the air, the ground service team goes into action by flagging the pilot to indicate the fields to be treated and the swaths to be made. A common method of providing the last-mentioned information is for two flag-men to walk along lines

at right angles to the line of flight while holding up markers at the edges of the last swath laid. (This is only necessary in spraying operations since, when dusting, the pilot can see the cloud still hanging over the previous swath.)

Pilots who have specialised in agricultural flying are gradually building up a new technique designed for the purpose which differs in many respects from normal procedure. Prolonged, low-altitude flying places a heavy strain on pilots and it is therefore felt that the successful agricultural pilot should be young (between 27 and 35 is mentioned as the best age) and at the same time emotionally stable and dependable.

In the U.S.A., considerable thought has already been given to the question of training new pilots for agricultural work. They are usually put through a training programme which includes low-speed, straight and level flying; stalling turns and fast recovery; nose-high sideslips; near-stall take-offs; landings with and without power; and high-speed stalls in pull-ups and turns.

Safety precautions

Safety precautions, of a kind not normally considered in connection with ordinary flying, become necessary when agricultural sorties are undertaken. In addition to safety precautions against flying accidents, it is also necessary to protect pilots and ground staff against the effects of poisonous chemicals. Care must also be taken to afford protection against similar dangers in regard to the civilian population, livestock, susceptible crops and wild life in the area treated.

It will be clear that the application of aircraft to agriculture is far more advanced in the U.S.A. than in Europe and indeed many may wonder whether there is the same scope for agricultural flying in the Old World as there obviously is in the New.

Technical mission

In this connection, it is of interest to consider some recommendations made by Technical Assistance Mission No. 107, comprising nine experts from Austria, Denmark, France, Germany, Italy and the Netherlands, which visited the U.S.A. under the sponsorship of the Agricultural Committee of the Organisation for European Economic Co-operation (O.E.E.C.). The Mission, which spent some considerable time in the U.S.A., felt that although agricultural aviation might never expand in Europe to the extent observed in the U.S.A. there is nevertheless ' enormous scope for making wider use of aircraft for agricultural purposes (in Europe) than is the case at present '.

Among the uses to which aircraft might be put in Western Europe are included, in the Mission's view, the production of potatoes, sugar-beet, olives, fruit and forest trees, as well as sowing rice and controlling weeds in wheat. It was also felt that wider use could be made of aircraft in the control of such pests as cockchafers, locusts, olive-fly, fruit-tree pests and mosquitoes. Other possibilities include aerial survey, forest-fire control and taking farmers on demonstration flights.

Because of the large proportion of intensive agriculture in Europe, the Mission felt that there might be greater prospects for the use of helicopters, which are not generally found to be an economic proposition in the extensive conditions of the U.S.A.'s agricultural scene.

On the basis of its trans-Atlantic studies, the Mission offered several practical recommendations, which included the establishment of a European Agricultural Aviation Centre which would provide a clearing house for the exchange of technical information between the U.S.A. and Europe. More recently, however, this proposal was examined by a committee of experts which considered that, for the moment, the suggestion was premature, but that an exchange between countries of technical and economic information on the use of aircraft for agricultural and forestry purposes would be highly desirable.

Another recommendation proposes a programme of research and experiment to develop the most suitable equipment, chemicals and application techniques for European conditions. Other research projects would include the development of new agricultural uses for aircraft in order to extend the operational calendar and the search for alternative employment for agricultural aircraft during the normal off-season.

It was also suggested that existing agricultural - aircraft companies in Europe should consider the formation of an Association whose aims should be the furtherance of their specialised interests and the safeguarding of the standards and reputation of the industry. One of the main tasks of such an Association should be the convening of an International Agricultural Aviation Congress to provide an opportunity for members of the industry to make personal contacts and to exchange information with their counterparts in other countries.

This suggestion is still under active consideration and the possibility of arranging an *ad hoc* meeting under the auspices of the European Productivity Agency is being explored. All those who are concerned in the role of the aircraft in agriculture will await with interest the future development of this proposal.

Photos: U.S. Information Service

Plastic Coatings for South African Citrus

If experiments now in progress are successful South African citrus shipments may be packaged in plastic coatings.

A machine to coat citrus fruit with a film of plastic, which, it is claimed, will preserve the fruit for six months, is being manufactured by an Eastern Cape firm. It is said that the plastic coating will not effect the taste or condition of the fruit in any way. The new process, if successful, will obviate the need for refrigerated space, precooling plants and special railway trucks.

It is thought that the first shipment of plastic-coated citrus will leave for the overseas markets during the forthcoming citrus season.

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Alternatives to Superphosphate

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Tests with various phosphates have been carried out both during and since the war in an attempt to find a substitute which, while doing the same job, will not make such heavy demands on sulphuric acid in its manufacture. The results obtained are summarised below. Some of the products, however, are not yet available on the commercial market.

SUPERPHOSPHATE is made by treating imported rock phosphate with sulphuric acid, much of which is made here from imported pyrites or sulphur. Regular supplies of superphosphate therefore depend on a regular flow of raw materials. During the war it seemed possible that sulphuric acid might become scarce, and the Ministry of Supply arranged for alternatives to superphosphate to be developed and tested in field experiments. Then in 1950 there was a world-wide shortage of sulphur, and the amounts of sulphuric acid available for making superphosphate were restricted. As a result of this, the Agricultural Research Council initiated field experiments to test phosphate fertilisers which either needed no sulphuric acid in their manufacture or which economised in acid. In this article the results of these two recent investigations have been used to guide farmers on the value of phosphate fertilisers which can be used as alternatives to superphosphate.

The value of basic slag for grassland and for many arable crops on acid soils is already well understood, and this fertiliser should be used whenever it is suitable for particular crops and soils, since the phosphoric acid (P_2O_5) which it contains costs only about two-thirds as much as P_2O_5 in superphosphate.

Direct application of ground rock phosphates

When supplies of acid for making superphosphate are restricted, an obvious alternative is to use ground rock phosphates, where they are suitable. The best phosphates for direct application are the soft rocks from North Africa, and the well-known material from Gafsa was tested in both series of field experiments.

For swedes grown on acid soils (with pH values below 6.5), North African rock phosphate was as effective as superphosphate, supplying between 60 and 90% as much phosphoric acid. In Great Britain swedes are now restricted to the north and west, where most of the soils are acid and rainfall is high. For most of these crops, therefore, ground rock phosphate could be used instead of superphosphate. (The price per unit of P_2O_5 in rock phosphate is little more than one-third of the price of unit P_2O_5 in superphosphate, if current subsidies are taken into account.)

Mixtures of rock phosphate and superphosphate have been sold in Northern Ireland for many years. In the experiments they were slightly more efficient than the equivalent quantity of rock sulphate for swedes, but, even on acid soils, they were only two-thirds as effective as the same amount of phosphoric acid applied in the form of superphosphate. For potatoes grown on acid soils, the mixtures were only half as effective as superphosphate.

Gafsa phosphate was shown in the experiments to be practically useless for potatoes grown on neutral soils (pH values above 6.5), and even on acid soils (pH values below 6.5) it was equivalent to only one-third as much P_2O_5 supplied as superphosphate. Rock phosphate and mixtures of rock with superphosphate are not suitable for potatoes.

On very acid soils, finely-ground rock phosphate gave the same establishment and early growth of reseeded grass as only one-third as much P_2O_5 supplied in the form of high-quality basic slag. The more soluble phos-

The response of weeds to phosphate; foreground: without phosphate — background: with mineral phosphate

phates, such as basic slag or superphosphate, should be used for establishing grassland, but rock phosphates may be used to maintain growth of established pastures on acid soils.

Silicophosphates

During the war the Building Research Station of the Department of Scientific and Industrial Research investigated methods of heating rock phosphates with soda ash and sand to produce readily available phosphate, which was called ' silicophosphate '. War-time field experiments with silicophosphate have already been described in *Agriculture*, 1946, **53**, 102. The product was tested again in the 1951–53 experiments.

On very acid soils (pH below 5.5) silicophosphate was practically equivalent to superphosphate for both swedes and potatoes. On neutral soils (pH above 6.5) silicophosphate was only one-half to three-quarters as efficient as superphosphate for swedes, and for potatoes it was much inferior on both the less acid and neutral soils. For reseeding of grassland on acid soils in the Welsh hills, silicophosphate and Bessemer basic slag behaved similarly.

Silicophosphate can be regarded as having much the same value as a very high-grade, highly-soluble basic slag. It may replace superphosphate for many purposes where soils are very acid, but on less acid and neutral soils it is inferior.

Dicalcium phosphate

Superphosphate contains water-soluble monocalcium phosphate. Dicalcium phosphate, which can be regarded as the half-way stage between rock phosphate and superphosphate, is not soluble in water. Mineral phosphate cannot be converted to dicalcium phosphate just by using less sulphuric acid than is needed for superphosphate. Instead, monocalcium phosphate must first be made and then converted to dicalcium phosphate by adding basic materials like lime or ammonia. In the war-time experiments fertilisers containing dicalcium phosphate were made by mixing slaked lime with superphosphate, but the dicalcium phosphate tested in the 1951–53 experiments was made industrially by dissolving phosphate rock in hydrochloric acid and then adding milk of lime to the solution. Dicalcium phosphate is important, since it is present in most phosphate fertilisers made by dissolving phosphate rock in nitric acid followed by ammoniation, and it is also formed when superphosphate is treated with ammonia.

There was no evidence in any of the war-time experiments on arable crops which tested mixtures of superphosphate and lime of the increased efficiency which would be needed to justify the expense of mixing superphosphate with basic materials. In experiments on potatoes carried out in 1951–53, pure dicalcium phosphate was more efficient than superphosphate on very acid soils (pH below 5.5), but on less acid soils (pH 5.5–6.5) and neutral soils (pH over 6.5) it was inferior. Phosphoric acid supplied as dicalcium phosphate had around 90% of the efficiency of P_2O_5 in superphosphate for swedes grown on all kinds of soils.

Powdered dicalcium phosphate, such as was used in these experiments, could replace superphosphate for many crops on slightly acid or acid soils. It might not be so satisfactory on calcareous soils or for crops which require a quick start from phosphate drilled near the seed. For these purposes, water-soluble phosphates are likely to be best.

Nitrophosphate

Most nitrogen fertilisers are now made by combining nitrogen (derived from the air) with hydrogen to form ammonia. If ammonia is oxidised, the nitric acid made can be used instead of sulphuric acid to dissolve rock phosphate and make it available to crops. When sulphuric acid is replaced by nitric acid in the ordinary superphosphate process the product contains, besides monocalcium phosphate, calcium nitrate, which makes it sticky and liable to cake in storage. Nitric acid processes are now used in a number of countries, but some method of preventing calcium nitrate being present in the fertiliser is usually adopted. The products are called ' nitrophosphates '. They usually contain ammonium nitrate and have most of their phosphate in the form of dicalcium phosphate.

Three nitrophosphates, made in different countries by three different processes, were tested in the 1951–53 field experiments. All three were inferior to superphosphate for potatoes, but were more useful on acid soils (pH below 6.6) than on neutral soils. In each group of soils the best product was only three-quarters as effective as the same quantity of P_2O_5 applied as superphosphate, the second was only two-thirds as good, and the third product was only one-third as effective. In most experiments on grassland $1\frac{3}{4}$ cwt. of superphosphate per acre was sufficient for maximum yields. Both on acid and on neutral soils all three nitrophosphates gave lower average yields of hay than superphosphate supplying two-thirds as much phosphoric acid.

Phosphoric acid in nitrophosphates was practically equivalent to P_2O_5 in superphosphate for swedes, and the three nitrophosphates behaved similarly for this crop.

In the different years of these experiments the same kinds of nitrophosphates have given variable results. It seems that the manufacturing processes have not been stabilised sufficiently to yield products with consistent performances. Phosphate in nitrophosphates behaves in much the same way as that in highly soluble basic slag, and a fair price for P_2O_5 in fertilisers of this kind might be three-quarters of the price of water-soluble P_2O_5. Although phosphates which are not soluble in water may give good results on very acid soils, nevertheless, such soils should be limed to obtain full crops. It is not in the interests of farmers, nor is it practicable, to suggest that soils should be under-limed merely to allow the crops to use certain kinds of phosphate fertiliser.

Future uses of the alternatives

These experiments have confirmed the usefulness of the 2% citric acid test for valuing powdered fertilisers like basic slag, silicophosphate and dicalcium phosphate. For ground rock phosphates no chemical test gives a satisfactory valuation, and it is more important to have a description of each product and to know the district from which it was mined.

The experiments have emphasised the value of water-soluble phosphates (such as superphosphate or ammonium

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Agricultural Progress in Yugoslavia

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What has been the effect of the radical agrarian changes that have been made during recent years in Yugoslavia? In this article some detailed accounts of the changes have been presented and the effects of them on the population and on agricultural productivity have been discussed at length. The emphasis in Yugoslav agriculture is placed on finding the most suitable long-term development plan for increasing her productivity as rapidly as possible.

MUCH foreign attention has been attracted by the agricultural situation in Yugoslavia, owing to the various changes that have been carried out in the postwar years. Main attention has been focused on her specific drive towards socialisation in agriculture and for her alleged withdrawal from it. Another point of interest is that Yugoslavia was well-known in prewar days as an agricultural exporter, but since the second world war she has imported a great amount of food. Is this change in any way connected with changes in her social and political structure? Is it due to increased home consumption by townsmen and rural workers? or is it in fact a consequence of a decrease in productivity? Has there been any progress in agriculture at all and, if so, of what kind?

Before the second world war three-quarters of the population were engaged in agricultural pursuits (according to the 1931 census 10,620,000 out of the total population of 13,934,000). Each 100 ha. of agricultural land supported between 105 and 110 people, of which approximately 80 were rural workers. In the main they were peasants, living at subsistence or semi-subsistence level, who used primitive cropping methods and kept 80 to 90% of the sown area under wheat and cereals; their own diet was poor. It must be remembered that great differences exist between various districts and counties in Yugoslavia, not only in geo-pedological and climatic respects (70% of arable land in the Danubian valley as against about 5% in the Montenegro; 81 people per 100 hectares of sown land in the Danubian valley as against 302 in Dalmatia and Herzegovina), but also in the state of development.

There are regions, such as the territory north of the rivers Sava and Danube, and in the extreme west (Slovenia and Istra), which have 100–200 years of tradition of agricultural Societies, and there are areas in the centre and south-east of Yugoslavia, which are mostly mountainous, which have been free of the Ottomanian oppression only during the last 50–100 years; and again there are the counties of the former Kingdom of Serbia which have hardly had 12 years of uninterrupted peace during the last 150 years. Also there are regions with the average standard of central European education and others where as many as one-third or more of agricultural population is illiterate.

Overpopulation

Although the beginning of the second world war found regions with relatively advanced techniques and traditions, especially in higher classes of holdings and on some of the larger properties, at the same time 18.3% of the holdings had wooden ploughs only and 38% were without a plough of any type. So it would seem that prewar Yugoslavia was particularly underdeveloped, with agricultural overpopulation, land hunger and low yields (see Table 1). On the whole, there was a very intensive use of the agricultural labour force and also there was a considerable export market of some agricultural products; but there was at the same time signs of malnutrition of the population, especially in rural areas. There were 42 head of cattle per 100 head of agricultural population. This figure can be compared with 151 head of cattle per 100 head of agricultural population in France, 384 in Denmark and 324 in the U.S.A. The war period 1941–45 saw a decrease of about one-third to two-thirds in the number of agricultural implements and livestock.

The peasant work co-operative 'Marko Orešković' in the Kikinda district, Vojvodina, is still hampered by lack of mechanisation

TABLE 1
YIELDS OF WHEAT AND MAIZE IN PREWAR YEARS, KG./HA.

	Wheat	Maize
1920-24	9.1	13.5
1925-29	11.9	14.5
1930-34	10.4	16.0
1935-39	12.1	16.8

The new regime, established during the Liberation War, considered that the very great number of small and ' dwarf ' holdings (and a division even of these) was important in achieving any considerable advancement in agriculture, particularly with the conditions of relative agricultural over-population and the low level of industrialisation and urbanisation that prevailed. The structure of holdings at the beginning of the second world war is shown in Table 2.

Early postwar trends

Though an amalgamation of smallholdings into big co-operative production units was considered the best solution to the economic and political problem, the trend at that time was not encouraged. However, the radical agrarian reform of 1945 was carried out and this cut down the maximum property size to 30 ha. The surplus was distributed among the smaller farmers. An exception was the establishment of some large State farms. In this way, the majority of the rural population was satisfied but, on the other hand, this measure caused a splitting of bigger, sometimes much advanced holdings, and presented a further obstacle to technical improvements and a considerable decrease of marketable surpluses. (See Table 3.)

At this stage the rural population began to eat more and better food. Meat, which formerly was available only once a week or even a fortnight, became part of the daily diet. Another factor that prevented the increase of productivity was the system of compulsory purchases of produce at the maximum price by the Government in the early postwar years. Although this was normal practice during the war, it was carried on as an unavoidable and essential means of keeping up the food supplies. The absence of such controls during the postwar years of underproduction and scarcity would have caused speculation and inflation and even perhaps a famine amongst the urban population. When continued in the postwar period the method of compulsory purchase was, to a great extent, encouraged by the Soviet example and was, at the same time, a means of progressive taxation. The allocation of these deliveries by the farmer was not questioned at first by the population, but later they became associated with all kinds of political measures, including bureaucratic mis-management and local autocracy. As time went on they came to have an increasingly depressing effect on productivity. The private agriculturalist had no assurance of what might happen if he increased his output. Finally, it was thought that if there were any surpluses they should have been used as internal consumer goods, and, as such, first priority belonged to the farmers who were completely ruined by the war and then to co-operative members. The same is true of the small available supplies of tools, machinery, fertilisers etc.

TABLE 2
STRUCTURE OF HOLDINGS IMMEDIATELY BEFORE THE SECOND WORLD WAR

Size of holdings, ha.	*Number of holdings, % of total*	*Area of holdings, % of total land area*
0-2	33.8	6.5
(0-5)	(67.9)	(28.0)
2-5	34.1	21.5
5-10	20.5	27.0
10-20	8.8	22.3
20-50	2.5	16.2
over 50	0.3	6.5

Peasant work co-operatives

In order to cope with the insecurity of supplies for the increasing urban population and with the great shortage of labour force, and to disperse the great number of small, low productive holdings, it was decided at the beginning of 1949 to press for peasant work co-operatives that is, co-operatives with common property and labour. This was influenced to some extent by foreign political considerations. The drive was stimulated by a promise of certain taxation privileges and an alteration in compulsory deliveries, by the distribution of better seed, implements, fertilisers and the promise of less and easier work, all this without administrative interference. The response was greater than expected.

There was remarkable technical and economic success in some work co-operatives and disappointment in many others. Taken on an average, the yield per hectare did not show any substantial increase above the productivity of private agriculturalists; the yields were sometimes lower, especially with newly introduced technical crops. At this period people were still aware of a general scarcity of consumer and industrial goods and many joined the work co-operatives only to secure better food for their families.

Owing to the lack of mechanisation, of fertilisers and agricultural experts, very little was done for the ' commassation ' of small holdings so that larger technical units could be established and thereby reduce manpower to a reasonable level, and so the work was for the most part organised on the basis of unchanged smallholdings rather than on the basis of homogeneous enterprise, and few people thought of adjusting production to meet market demands. The workers remuneration was egalitarian; wages were low but there was some improvement later.

Despite regulations and agreements, the co-operatives in the existing mass psychology did not take into account the ' capitalistic ' rent on the land and compensation for implements, livestock etc. that were brought into the collective. In keeping with the trend of thinking that hard work and socialism were incompatible, people worked

TABLE 3
THE STRUCTURE OF HOLDINGS AT THE BEGINNING OF 1949

Size of holdings, ha.	*No. of holdings*	*No. of holdings, %*	*Area, % of total*	*Percentage of arable land*	*Average number of ha. per holding*	
					Total	Arable
0-5	1,489,744	65.6	34.0	38.2	2.5	1.9
5-8	373,256	16.5	21.6	23.2	6.2	4.6
8-10	117,933	5.2	9.7	9.9	8.9	6.3
10-15	129,200	5.7	14.8	13.7	12.3	7.9
over 15	92,096	4.0	19.4	14.4	22.8	11.6
Work co-operatives	68,023	3.0	0.7	0.6	0.7	0.6

less intensively than on private lands and enjoyed all kinds of purchasing allowances, forgetting that on the collectives they did not differ from the private agriculturalists as far as mechanisation is concerned. As members of families preferred to remain together in the comparatively easy life of co-operative farms rather than for some of them to leave home and enter into industry, the work co-operatives neither produced nor increased the market surplus for the urban population. It was a happy state of affairs for them, for they worked less and ate more, but the State did not benefit by increased production.

Dissolution of work co-operatives

Remembering the situation and in an endeavour to restore the national economic balance, the Government resolved in 1952 to support only those work co-operatives that had proved technically and economically to be self-supporting in free market conditions, and so it was decided not to oppose the dissolution of other peasant work co-operatives should the members so desire. By the slow suspension of support a gradual dissolution of prematurely constituted work co-operatives was ensured and, for the future, it was decided to aim at the development of work co-operatives in the light of past experience, e.g. assist them by example and experience, with more mechanisation and the provision of expert personnel. Furthermore a longer training in general co-operatives would be required before workers entered the work co-operatives.

In the early postwar years general co-operatives, although their importance was stressed and they received all kinds of privileges, were used as a distributing centre for commodities in scarce supply. They were also used to implement the rationing scheme and they played some role in suppressing speculation and inflation. Some years later, work co-operatives began to receive the greater part of the Government's attention, but since 1952 all types of agricultural co-operatives have received equal attention. The agriculturalists of different groups and different localities have been left a free choice of the type and form of association they wish to form. These units are entirely self-managed either as an association for common use or for broader application of mechanisation in the fields of production, processing and transport, or as specialised co-operatives for irrigation and drainage, as associations for joint production of specific commodities (fruit growers, livestock etc.), farmers' food-processing associations (dairies, wineries etc.) or as savings and credit associations. The more these associations use their own initiative in increasing production and setting up their administration and organisation, the more progress in productivity and income is expected.

Workers get together to build a co-operative house on the farm

The 1953 regulations

The new law and regulations of 1953 are more liberal and flexible with regard to the structure of work co-operatives, it even permits members to hire land and to arrange their own terms of rental and other agreements. Disputes are settled by regular courts and each member is allowed to withdraw with his property every third year, or to change the conditions subject to the approval of the plenary meeting of members.

Thus, between 1952 and 1953 the number of work co-operatives dropped from 1,505,000 to 116,000 and the total co-operative area from 1,665,000 to 282,000 ha. On the other hand, membership of specialised co-operatives has risen from 26,135 to 37,823 in the corresponding period. It should be noted, however, that the membership of the general co-operatives is decreasing, from 3,162,062 in 1952 to 2,035,000 in 1954, but their quality,

funds, turnover and number of shops is slowly being consolidated and the area has increased from 68,300 to 144,974 ha. between 1952 and 1954.

Generally speaking, the general co-operatives are today in a stronger position than ever they were before. It would, however, be misleading to conclude that the Yugoslav agriculturalists withdrew *en masse* from the collective farms into private peasantry; they, in fact, shifted from this form of co-operative arrangement into a great variety and combination of other, not so closely-knit, forms of co-operatives. Now the general co-operatives are expected to play a leading role in the planned socialist reconstruction of the rural sector.

Another important measure was the abolition of compulsory deliveries between 1950 and 1951; this was made possible by increased industrial production, mainly of consumer goods (textiles etc.). Some minor moves towards a freer market have already contributed towards increased production. These moves include a reduction in prices for industrial goods to those who produced grain in excess of the compulsory quota, and an advance determination of the delivery quota (before the sowing campaign instead of after the harvest). Compulsory deliveries of grain, meat and wool were abolished in 1952 and this step, together with the greater freedom of prices and a return to the cadastral system of taxation, resulted in a promising increase of productivity. This, however was impeded to some degree by the slow progress in the availability of investment goods (machinery etc.).

The 1953 reform

A new agrarian reform was promulgated in 1953; it permitted a maximum private holding of 10 ha. of agricultural land and it affected mostly those workers who had withdrawn from work co-operatives. The surplus land brought about by the new decree was distributed among those co-operatives that could guarantee to make successful economic use of it. The private land owners are now able to sell and buy land within that limit.

(The 10-ha. limit was set as it was considered to be the optimum size of a property to be cultivated without hired labour; it seemed compatible with the socialist principle of admitting no exploitation either in industry or agriculture. On the other hand larger enterprises can be owned both in industry and in agriculture by a co-operative society, but these are managed by the workers employed in them and the income is divided according to the results achieved.)

TABLE 4

THE AVERAGE YIELDS OF WHEAT AND MAIZE FROM 1945–54, KG./HA.

	Wheat	*Maize*
1947-51	12.0	15.6
1948	13.4	17.2
1949	14.1	16.6
1950	10.3	9.3 (drought year)
1951	12.9	17.1
1952	9.1	6.4 (drought year)
1953	13.3	15.9
1954	7.5	12.2

TABLE 5*

LIVESTOCK POPULATION FROM 1931 TO 1955, IN THOUSANDS

	Cattle	*Sheep*	*Pigs*
1931	4,875	5,036	12,287
1949	5,278	4,135	11,654
1950	5,248	4,295	10,046
1951	4,740	3,917	10,276
1952	4,834	3,999	10,522
1953	5,007	4,527	11,404
1954	5,097	4,310	12,112
1955	5,273	4,731	11,935

* The figures in Table 5 reflect very sensibly the main features of the changing economic policies and the effect of climatic conditions.

It is difficult to make a fair appraisal of the results obtained, especially if these results are compared with those obtained in 1940. Many unusual factors have intervened in that time in the form of abnormal droughts and an economic blockade, and there is no doubt that the radical and frequent changes in economic policies have had their effects. But on the whole average yields have risen since the 1945–47 period although they have not yet reached the prewar figures. (See Tables 4 and 5.)

Between 70 and 75% of the total sowing area has been sown to grains during the last five years and there has also been an increase in the acreage of industrial crops. But no progress has been made in commassation, and fragmentation of land remains a serious problem in mountainous districts.

Machinery and implements were able to be gradually replaced from about 1950 but it has been a slow process. Yugoslavia possessed only 2,500 tractors before the war, 1 per 2,900 ha. of arable area. In 1954 the total was 8,500 or 1 per 1,000 ha. of sown surface. In 1938 the use of fertilisers (N_2,P_2O_5 and K_2O) amounted to 1.1 kg./ha. In 1950 the figure was 2.5 kg./ha. and the figure is steadily rising.

Extension work

Considerable progress has been made in improving cultivation methods in backward areas, particularly in livestock-feeding methods, in cattle breeding and in the eradication of some pests and diseases. Yugoslavia is fortunate in that she has not been afflicted by the dread foot-and-mouth disease. Attention has been given to agricultural research in experimental stations etc. and study courses for agricultural education are available at many specialised schools throughout the country. This type of extension work however, is still not so far advanced as in most other countries, and marketing and finance methods still leave much to be desired. It is true that since 1950–51 investment credits were increased to a considerable level and also both investment and seasonal credits were easier to obtain by private agriculturalists (through co-operatives) but more could be done. Economics research, until recently, was practised by agriculturalists as a hobby and has yet to be placed on a firm scientific basis with the use of modern methods.

Conclusion

Some long-term development plans for agriculture have been projected, including measures for comercialisation and regional specialisation, but were postponed owing to certain criticisms. In the past ten years, emphasis has been placed on industrial development, but now an equivalent amount of assistance should be given to agriculture thus placing it on an equal footing with industry, and perhaps it could even be assisted to some degree by industry and trade. This would allay the fear expressed by some Yugoslav economists that Yugoslavia might, in the long run, be only an agricultural importer. This supposition is supported by the fact that postwar population is increasing at a faster rate than the domestic food production. The

total wheat production in the late 1930s ranged from 2.3 to 2.9 million metric tons as against the 1950 production of 1.68 to 2.28 million metric tons. This means a decrease from 150 to 185 kg. (prewar) against 80 to 150 kg. (postwar) per head of population. The decrease in the production of maize over the same period was 3.0 to 5.3 million metric tons to 1.47 to 4.04 million metric tons. A similar decrease per head of population is shown in the livestock figures. One must now take into account the greater percentage of urban population and their higher consumption of food but, without a doubt, the country is trying to check this trend with a rapid development of agricultural productivity and she is at all times trying to find the most suitable long-term development plan.

Harvesting with tractors in a peasant work co-operative on the Danubian plains. This is one of the more advanced co-operatives

Alternatives to Superphosphate

Continued from page 152

phosphate) for most crops and for most classes of soils. No insoluble fertilisers are consistently more efficient than superphosphate. For certain crops, and particularly on acid soils, water-insoluble phosphates may be used when they can be bought more cheaply than soluble phosphate. Newer methods of manufacturing fertilisers are likely to be introduced in the U.K. during the next few years to cheapen costs of production, and to obtain high-analysis materials with suitable ratios of plant nutrients. Anhydrous ammonia is a very cheap and concentrated source of nitrogen in many countries, and it may become convenient to ammoniate superphosphate here. If nitric acid can be made cheaply enough, then nitrophosphates may be produced. Both processes give fertilisers containing dicalcium phosphate. The agricultural valuation of these kinds of granulated fertilisers has not yet been settled. It may become an increasingly urgent problem as new manufacturing processes are introduced to keep pace with increased fertiliser usage.

Acknowledgment

This article was reprinted, with permission, from *Agriculture*, 1955, **62**, 27

Photo: G. W. Cooke

Nyasaland Agricultural College

A new £37,000 agricultural and veterinary training centre for Nyasaland was opened in March by the Governor, Sir Geoffrey Colby, at the Chiredzo Agricultural Research Station, near Lilongwe. The school, paid for by the Colonial Development and Welfare Fund, will provide accommodation for 100 resident students. It will train African students as agricultural instructors and veterinary assistants. An advanced course will be provided for exceptionally promising students to qualify them to fill senior posts in the Nyasaland Agricultural Department. In addition, since agriculture is now an important subject in all Nyasaland primary schools, special teachers' training courses will be held at the new school. Arrangements will be made for all teachers in training to attend.

Picture taken at the Ninth Dalton Lecture, which took place at the Town Hall, Manchester. Sir William Ogg, M.A., PH.D., LL.D. *(second from right), presented his paper entitled ' Chemistry and Crop Nutrition' See* WORLD CROPS 1956, **8**, 118

Mechanisation in French Agriculture

J. BERTIN-ROULLEAU

M. Bertin-Roulleau is a contributor to several journals in the Leonard Hill Technical Group and he has a wide knowledge of technical affairs in France. In this article he surveys the progress in agricultural mechanisation in that country from the time of the Liberation until 1955. The author raises an interesting point when he says that French farmers are, or were, slow to buy French-manufactured equipment because it was not up to the standard required.

TO speak of the problem of mechanisation in France in a short note makes it necessary to take 1945 as a starting point and to show how the production of agricultural machinery has progressed since the Liberation. The symbolic character of the interdependence of agriculture and industry should be remembered.

In 1938 French agriculture was probably less advanced than that of most other modern countries. Whereas England had 172,000 tractors, Germany 140,000, Russia 480,000 and the U.S.A. 2 millions, France possessed only 30,000 tractors of which approximately 25,000 were serviceable. This meant that France had 1 tractor/650 ha. against 1 tractor/40 ha. in England and 1 tractor/70 ha. in the U.S.A.

This situation in France was noted by the ' Pouvoirs Publics ', who, since 1945, have studied the possibilities for French agricultural machinery development. It was decided that it was necessary to increase production to meet home needs and eventually to supply an export market.

It was then estimated that France requires 250,000 tractors. This will mean that 700,000 horses can be dispensed with and, as each horse consumes 10 kg. of fodder per day, this would amount to a considerable saving.

With 250,000 tractors France will have 1 tractor for each 80 ha. as against 1 tractor/40 ha. in England. The tractors for France could be divided into the following categories: 30,000 tractors of 50 h.p. for heavy work, 120,000 of 20 h.p. for medium work and 100,000 of 10-15 h.p. for small farms and miscellaneous applications.

Thus there is a great need for a tractor industry in France.

Present situation

On 1 January, 1955 France had 1 tractor for each 73 ha. of cultivable ground. Progress has been good.

The sale of tractors in France increased by about 22% from 34,000 in 1953 to 42,000 in 1954. This increase is explained by two factors: (*a*) an increase in the farmer's purchasing power through better yields and a 15% reduction in the prices of agricultural machinery; (*b*) a better adaptation of production to meet market requirements. At the present time mechanisation principally affects holdings of 30-50 ha., which require tractors of less than 30 h.p.; the range of models for this category is now more varied than was the case immediately after the Liberation.

Of the 42,000 tractors sold in France in 1954 about 35,000 were manufactured in that country.

But we must not be deceived. This large sale of home-produced tractors is not due solely to quality or low price; the industry is protected by customs restrictions and heavy duties.

This situation devolved from a French predilection for foreign materials. Immediately following the Liberation, some farmers bought home-produced tractors which they found were not of high quality. This made the prudent farmer mistrustful and it is difficult to overcome this prejudice.

Price

This is another disadvantage for French tractors. The Farmall C actually costs Fr.845,000, although the Ferguson, imported complete from Great Britain would sell at Fr.668,000. And again the Farmall FCN, with a diesel engine constructed in France, costs not less than Fr.1,150,000, whereas the Allis Chalmers B, with similar motive power, would retail at about Fr.875,000. And the quality of British material is without reproach!

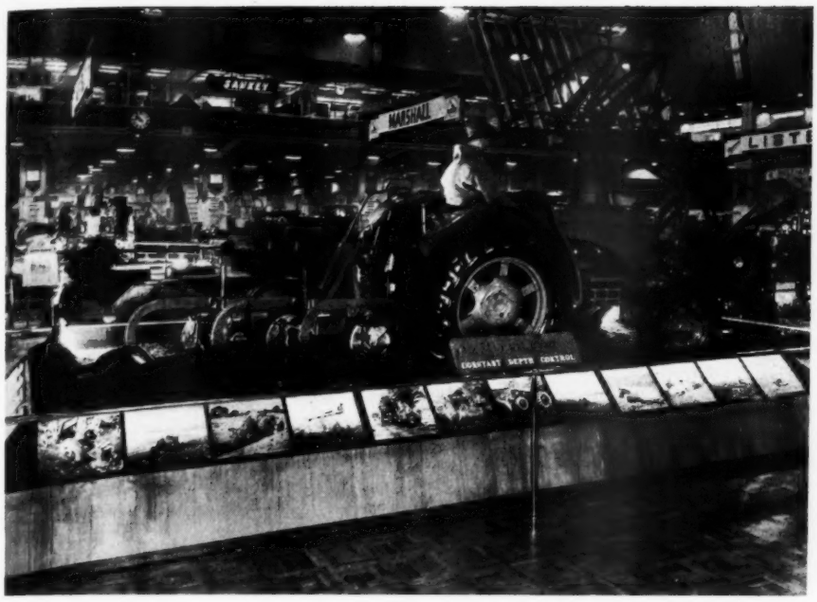
But the French manufacturers, who, in these conditions, export very little are able to blame the heavy social and fiscal burdens placed on them. This, however, does not totally justify such a huge discrepancy in price. There is a lack of ' go-ahead ' spirit in the industry.

A particular fault in France is the insufficient concentration as opposed to England and Germany. In France about 30 constructors manufacture less than 50 tractors per year. No one firm in Britain or West Germany fits this category: more than 30 French firms manufacture in excess of 50 tractors per year but in Britain there are 14 manufacturers in this category. Even better, in 1954, the output of the premier French manufacturer did not exceed 9,000 units as against his similarly placed British counterpart with 60,000. From recent calculations, it is seen that France ought to manufacture 50,000 units per year in order to make home prices competitive with imported machines. Only two French manufacturers can meet this challenge.

Harvesters etc.

What is the situation for other types of agricultural machinery? Even though it may be satisfactory for horse-drawn machinery such is not the case for implements requiring mechanical traction.

France has approximately 500,000 reapers and binders but she has only about 15,000 combine harvesters. The



This photograph was taken at the International Agricultural Exhibition, Paris, 1953. Overseas manufacturers of agricultural machinery were well represented. This moving exhibit was designed to illustrate a feature of the David Brown system — constant depth control when ploughing. It formed the centrepiece on the stands of Ets. Ferga, David Brown distributors

combine harvesters are, however, of more interest to the C.U.M.A. (co-operatives), the contractors and the larger farmers. Three main models are available, one of which has a cutting width of more than 3 m. Nevertheless, besides these specialised combine harvesters, which are worth Fr.2,500,000 to Fr.4,000,000, there are simpler machines that the small farmer can buy from Fr.750,000.

Buying restricted

But despite these opportunities, the farmer does not display much enthusiasm for these units. In fact a census has shown that this is so, for relatively few machines of this type have been purchased.

The figures are:

1952	10,150 units.
1953	12,500 ,,
1954	15,150 ,,

A curious fact arises in that it is in the East, i.e. l'Aube, la Côte-d'Or and Meurthe-et-Moselle, that the sales are increasing more rapidly.

By comparison with other countries, however, France is not in such a poor position with this type of machine as she is with tractors. The U.S.A. has one million combine harvesters, Canada 120,000 and France comes somewhere between the U.K. with 22,500 and Western Germany with 4,000 units. Russia, of course, is well forward.

Judging by the annual sales of combine harvesters, about 2,650 in 1945 (of which 850 were imported), it seems that the home market is fairly restricted.

Malayan Pineapple Production Lags

The Chairman of the Central Board of Pineapple Packers has stated that there are not enough pineapple plantations to supply the needs of Malaya's six canneries, which are now working below maximum capacity. He said that if the Federation Government would release more land for new plantations the industry could, in three years, surpass the prewar production of $2\frac{1}{2}$ million cases a year. The present production is about 1 million cases, which are exported mainly to Britain and the U.S.A.

Erratum

In the article entitled ' Soya-bean Adaptation in Sweden ', which was published in the March issue of WORLD CROPS, the fifth line of the third column on page 100 should have read ' 13% less than at lat. 40°. . . . '

Tillage Decline in Northern Ireland

Having regard to the unfortunate harvesting conditions of 1954, a substantial fall in the area under cultivation in 1955 was not unexpected, stated the Queen's Speech, read by the Governor (Lord Wakehurst), at the recent opening of a new Session of the Northern Ireland Parliament. This decline was particularly noticeable in the acreage of the two principal crops, oats and potatoes, and despite the increased area of grassland the numbers of livestock also decreased.

It was most desirable that more land should be tilled and that there should be some extension in the production of oats, which were so valuable for stock-feeding. An increase in this crop would reduce the volume of imports of feeding-stuffs, with consequent benefit to the national economy. For the same reasons the Ulster Farmers' Union was using its influence with its members to induce them to extend the acreage under the plough in the coming year.

The building of houses continued at a satisfactory rate and many farmers, with the assistance of grants under the Housing on Farms Acts, were being helped to improve their family dwellings and to enjoy the advantages of modern amenities.

A Bill would be introduced to amend the Agricultural Wages (Regulation) Act, 1939, in order to make additional provision for holidays with pay for farm workers.

World Food and the Scientist

The University of London, Department of Extra-Mural Studies, will hold a University Extension Residential Week-end Course at Wansfell Adult College, Theydon Bois, Essex, from 4–6 May, 1956 under the general title ' World Food and the Scientist '. The lectures will be given by Prof. H. W. Miles, D.SC., PH.D. and Prof. R. L. Wain, D.SC., PH.D., F.R.I.C. The Course will be divided into two broad sections, the first of which will deal with the struggle for existence and the second will outline the role of science in increasing and conserving world food supplies.

NEW PUBLICATIONS

The Agricultural Economy of the Danubian Countries 1935-45

S. D. Zagoroff, Jenö Végh and Alexander D. Bilimovich. (Edited with the assistance of P. Stanley King.) Pp. xiv + 478, illustrated. Stanford, California: Stanford University Press; London: Cumberlege. 1956. 60s.

This publication is a brilliant and detailed analysis of the agricultural systems that have prevailed in the Danubian countries, which for this purpose are those countries in the Lower Danube Basin, i.e. Hungary, Rumania, Yugoslavia and Bulgaria. It shows, without any equivocation, that the agricultural economy of the Danubian countries was characterised by a decline in agricultural production and in food consumption during the second world war.

In the first of five sections the premier author, Dr. S. D. Zagoroff, provides a general survey of agriculture in the four Danubian countries. The survey presents an account of the integrated history of land tenure and the rise and decline of peasant freedom in this area during the last 100 years —the liberation of the peasants from serfdom during the nineteenth century, the abolition of coercive labour and the redistribution of farmland in the first half of the twentieth century. Finally it describes the socialisation of agriculture which has been taking place in recent years. The author summarises these important changes as follows:

'1. *Political and agrarian reforms under foreign and national rule during the nineteenth century.*—Liberation of the peasants from serfdom in the Lower Danube Basin except in Bosnia and Herzegovina (*de jure* liberations 1848–64; *de facto* liberations 1815–1912).

'2. *Agrarian reforms after World War I* (1918–24).—Abolition of serf labor in Bosnia and Herzegovina (Yugoslavia); abolition of colonate in Dalmatia (Yugoslavia); abolition of coercive labor in Rumania; redistribution of farmland in all four Danubian countries—expropriation of latifundia in Rumania and Yugoslavia, and of all classes of large land properties in Bulgaria.

'3. *Agrarian reforms after World War II* (1945–46).—Adoption of direct land exploitation as principal system of land exploitation in Hungary; redistribution of farmland in all four Danubian countries—expropriation of all classes of large land properties in Hungary, Rumania, and Yugoslavia.

'4. *Socialization of agriculture* (*since* 1948).—Introduction of collective farming or, more precisely, of corporative farming based on authoritative act in all four Danubian countries.'

The general survey also presents a computation of the food balance, in terms of energy, for each of the four countries.

In each of the next four sections each country is treated as a separate entity. Jenö Végh, a Hungarian economist, contributes an account of the agricultural economy of Hungary. This survey covers the historical background, land tenure, agricultural production, food supply and position of agriculture in the national economy.

Dr. Zagoroff provides similar surveys for Rumania and Bulgaria and Alexander D. Bilimovich covers Yugoslavia. All three men are well qualified for their respective tasks, and although their views may be specialised, as sometimes is the language employed by them, they have joined together to present a total picture of the ever-changing pattern of agricultural production in these countries.

They have clearly shown the effects of the second world war on the economy of the area as a whole and have logically led up to a comprehensive description of the results of socialisation in agriculture.

This eighth publication in the Food Research Institute series entitled 'Food, Agriculture, and World War II' is a first-class example of typography, tabulation and bibliography — altogether it is to be recommended not only to serious thinking agriculturalists and economists but also to students interested in reform in all its phases and especially those to whom the Danubian countries have special significance.

E.L.B.

Reports

FAO Publications

The International Effects of Nation a Grain Policies, Commodity Policy Studies No. 8, $0.25 or 1s. 3d. This paper was presented originally to the Twenty-Fifth Session of the FAO Committee on Commodity Problems (May 1955), following a Resolution of the Seventh Session of the FAO Conference (November–December 1953), which called for a study of the international repercussions of national price policies for major agricultural commodities. It was first published in two instalments in the July and August 1955 issues of the FAO *Monthly Bulletin of Agricultural Economics and Statistics*. The study is mainly the work of J. W. Evans and S. D'Amico of the Economics Division of FAO.

The Stabilization of the Olive Oil Market, Commodity Policy Studies No. 9, $1.00 or 5s. 0d. This study was prepared by the Fats and Oils Section, Commodities Branch, as a staff paper for the second meeting of an intergovernmental Working Party on Olive Oil, established by the FAO Committee on Commodity Problems. A summary of the Working Party's subsequent findings and conclusions is given in Annexe II. The original paper has been revised in the light of changes in the draft intergovernmental agreement on olive oil made by the Working Party at its second meeting, and in accordance with information obtained since that date, (March 1955). Acknowledgement is made of a number of helpful suggestions contributed to this study by Dr. Oscar Zaglits, FAO Consultant.

Grain Exports by Source and Destination, July 1954–June 1955, $0.25 or 1s. 3d. The data given in the tables of this publication show gross exports of the specified grains (excluding all products except wheat flour) for the most part as indicated in the official trade sources of the exporting countries.

Yearbook of Forest Products Statistics, 1955. This edition of 'Yearbook of Forest Products Statistics', prepared by the Forestry Division of FAO, contains information from more than 120 countries for 1954. Data for 1953, revised as necessary, are also included.

During the last ten years FAO has continually sought to improve the

coverage and standard of international forestry and forest products statistics. The 1955 yearbook includes more complete and more accurate data, from more countries, than any of its predecessors. Price $2.50.

Commodity Series, Bulletin No. 27, Cacao. November 1955. A review of current trends in production, price and consumption. Price $1.00 or 5s. 0d.

An Annual Review of World Production and Consumption of Fertilizers, 1955. This booklet, by means of tables and text shows how the increase in world production and consumption of fertilisers has been maintained during the period from 1953 to 1956. Countries which use fertilisers heavily have continued to increase production and consumption, and many other countries who have used little fertiliser in the past have begun to expand consumption and are establishing new industries to produce the fertilisers needed.

The forecasts now made for 1956 predict increases over 1955 in production and consumption of all fertilisers ($N \times P_2O_5 \times K_2O$) amounting to 4% and 3% respectively.

If the 1956 forecasts are achieved, production and consumption of all fertilisers will have increased by 21% and 18% respectively in the three years from mid-1953. Price $1.00 or 5s. 0d.

Bibliography of Land and Water Use in Europe, 1955. Under this general title, a bibliography has been collated by C. H. Edelmann and B. E. P. Eeuwens on the following—General and Agricultural Geography; Maps, Climate, Soils, Vegetation, Hydrology and Hydrography, Land Reclamation —Drainage—Irrigation—Consolidation of Fragmented Holdings and Soil Erosion and Soil Conservation. Price $1.50 or 7s. 6d.

Seeds of Progress, United Nations $0.30 or 2s. 0d, Sw. Fr. 1.20. The stories in this book tell of the work of FAO experts who have gone out from their homes to survey the ' Expanded Programme of Technical Assistance ', as international civil servants. The booklet offers a very small, but typical, selection of their experiences.

British Standards Institution, B.S. 2659:1955; B.S. 2687:1955. B.S. 2659 is entitled ' Dimensions of Agricultural Cultivator Tines ', and it provides for a complete range of cultivator tines for tractor-drawn and -mounted cultivators, for all horticultural and agricultural purposes, with regard to dimensional requirements of the lower portion of the tine to which the cultivator points are attached.

Dimensions given are limited to those necessary to ensure that cultivator points designed to fit tines which conform to a type specified in this standard will be interchangeable one with another, within any one subdivision of that type. The standard is well illustrated with very clear drawings. Price 3s. 0d.

B.S. 2687:1955 is entitled ' Agricultural Discs ', and this standard specifies requirements for flat and concave agricultural disks with regard to the quality and dimensional interchangeability of disks of the same type and nominal size. The main purpose of the standard is to provide various sizes of disks to meet the requirements of a wide range of conditions of work. Price 2s. 6d.

The Fruit Annual 1955-1956 London: British-Continental Trade Press Ltd. This record volume of 608 pages is even more comprehensive than ever before, covering in its editorial chapters every phase of the international fruit trade and production of fresh, dried, canned, frozen fruit and nuts. The encyclopaedia of fruits, a chapter called ' Market Fruits and their Varieties ' lists in 80 pages every kind of fruit on the world's markets, giving a description and other data, tabulated for the principal varieties. The new development of packing citrus fruit in cartons is dealt with by an expert on this subject, the American Roy J. Smith; modern storage methods are surveyed by Eric Hardy, and prepacking for the retail trade by Edward Hammond. Other chapters deal with dried fruit, nuts and tropical fruit.

The reference section includes the Fruit Supplies Calendar, fruit terms dictionary, list of trade organisations and specialised journals throughout the world, and the shipping guide gives details of ships and regular lines for the transport of fruit by sea. The World Directory lists over 5,000 firms engaged in the packing, wholesale distribution and canning of fruit, suppliers of machinery, and equipment and material for fruit processing and packing. There is also a buyers' guide and a list of trade marks. Price 20s. 0d.

Potassium Symposium, 1954, Bern, International Potash Institute. This volume transmits to the reader the full contents of lectures delivered, all in their original language, at the International Potash Institute at Zurich, and a summary in four languages is appended to each lecture. Such eminent scientists as Prof. Dr. H. Deuel, Prof. L. Wiklander, Prof. Dr. A. C. Schuffelen, Prof. Dr. G. Torstensson and Dr. Thomas Walsh, have contributed papers to this very comprehensive symposium.

Department of Agriculture in Jamaica, Commodity Bulletin No. 1, Bananas, by D. W. Rodriquez, M.SC., B.A. Kingston, Jamaica: The Government Printer. 3s. 6d. This Bulletin provides an outline of the economic history of production and trade in bananas with particular reference to Jamaica.

Department of Horticulture, Government of Mysore, India. We have received copies of the Administration Report for the year 1952–53 and the Annual Report for the year 1953–54. It seems a pity that these publications are received so late, for much of the work reported in them is outdated before it is brought to the attention of agriculturalists etc. Nevertheless, there is much material in both these reports for those interested in Indian agriculture.

Rain-making: Its Present Position and Future Possibilities, by A.K. Roy, 1955. New Delhi: Council of Scientific and Industrial Research. Mr. A. K. Roy, Officer-in-Charge of the Experimental Rain and Cloud Physics Research Unit under the council of Scientific and Industrial Research has prepared this Bulletin. He gives an outline of work done up to the present time on artificial rain-making and suggests possible lines on which experiments might be undertaken in India.

Guide to the Use of Fertilizers in Central Africa. 4th edn. 1955. Salisbury, South Rhodesia: Central African Fertilizers Ltd. The 4th edition of the ' Guide ' is an attempt to summarise the latest trends in crop production. It is written in the hope

that those actively engaged in the agricultural sphere will gain some assistance from the information outlined, to help in raising the yield and the quality of their crops and at the same time increasing soil fertility. The booklet also serves to familiarise the readers with the more important facts about plant foods in concise, non-technical language.

OEEC Publication

The Market for Apples and Pears in OEEC Countries Price $0.50, 3s. 0d. or 150 F. fr.

Capital in United Kingdom Agriculture: Present and Future, 1955. London: The Netherhall Press. This booklet, prepared by Stephen Cheveley and Owen Price of the Central Agricultural Control, Imperial Chemical Industries Ltd., presents a survey of the capital position in U. K. agriculture. The facts have been compiled from many sources. In the second half some speculative and controversial subjects have been explored and they deal with such subjects as ' Capital Required for Farm Buildings ', ' Expansion in Grassland Output ' etc. Price 2s. 6d.

National Institute of Agricultural Botany. The 1956 edition of the well-known Farmer's Leaflets on Cereals published by the N.I.A.B. are now available. They have been sent to all Fellows of the Institute, and are available from the Secretary, N.I.A.B. Huntingdon Road, Cambridge, post free.

The Leaflets include the changes recently announced in the Recommended Lists. Details are included of the new spring-wheat varieties Peko and Svenno, the winter wheat Banco, which are now provisionally recommended, and the winter wheat N59 which is now provisionally recommended only for use in the North.

As usual the main characteristics of each variety are set out in tabular form, and short descriptive paragraphs emphasise the most important features. Several varieties are marked to be removed from the recommended lists in January 1957 or 1958.

The Leaflets received are: No. 2, Spring Wheats and Barleys; No. 8, Winter Wheats; No. 9, Winter Oats and Barleys; No. 13, Spring Oats; No. 12, Rye.

Farm Weeds. London: Shell Chemical Co. Ltd. This booklet has been designed with the object of helping the farmer to recognise the weeds on his land, so that he can determine the most effective type of control and rate of application to be adopted. This second edition contains sixty plates grouped under Arable Weeds, Arable and Grassland Weeds and Grassland Weeds.

1956 Potato Handbook. New Brunswick, New Jersey: U.S.A.: The Potato Association of America. The official Potato Handbook, published by The Potato Association of America is devoted primarily to Potato Seed Certification and contains over 20 articles, by nationally recognised authorities on Seed Potato Certification, Potato Breeding, Winter Testing New Varieties, Seed Treatment, Seed Storage and Potato Marketing. It also contains a list of all of the potato varieties that were certified for seed in 1955 and the addresses of the certification agencies where the growers' names may be obtained.

There is also a large Buyers' Guide listing the names and addresses of manufacturers and distributors of products used by the potato grower and handler. Price $2.00.

The Diesel and Farm Tractor. London: Shell and BP Farm Service. This booklet by C. W. Chapman, M.ENG., M.I.MECH.E., has been produced with a view to setting out in simple, non-technical language the essential differences between the diesel and spark-ignition types of engine and the precautions to be taken to ensure trouble-free service. It is intended as a supplement to, and not to take the place of, the instruction book issued with any particular machine.

Other Publications

We have received a copy of the following publication:

Annual Report 1954, Experiment Station, Indian Tea Association.

Many improvements have been made to the site formerly owned by the C.D.C. on the island of Eleuthera in the Bahamas. The Rock Sound Club is an example of what has taken place under private enterprise since the property was vacated by the C.D.C. Managed by Mr. W. K. Bourke, it has become a showplace on the island. The photograph shows some of the grounds and the swimming pool set in pleasant surroundings (*See* WORLD CROPS, 1956, **8**, 107)

Photo: Freddie Maura, Nassau]

MACHINERY AND EQUIPMENT

Rotary Cutter

E. L. Caldwell & Sons of Corpus Christi, Texas, U.S.A., has added a new model to its rotary-cutter line, which now includes 11 machines with cutting widths ranging from five to 12 ft. The new model's code name is S-5. It will cut a 60-in. swath, and is equipped with a reversible spring-steel blade of special alloy.

Although designed for cutting farm crop residue, particularly stalk crops, such as maize, cotton, and grain stubble, it will handle brush up to 2 in. thick, according to a Caldwell spokesman.

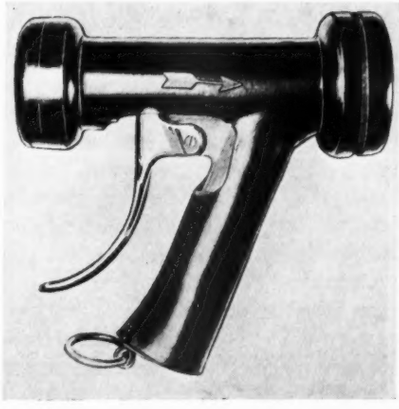
Light-weight auxiliary tips are made for attachment to the ends of the machine's standard blade, and when used the S-5 will pick up, cut and shred crop residue that is down. The new model is equipped with a heavy-duty Blood Bros. universal joint. The p.t.-o. shaft carries a standard knuckle. The S-5's blade is adjustable from ground level to 12 in.

Spray Nozzle

Meynell and Sons Ltd., Montrose Street, Wolverhampton, Staffs., have obtained the manufacturing rights, for production in England under licence, for a Water-Saver Spray Nozzle to be known as the Meynell Spray Nozzle.

It is suitable for use with both plastic and rubber hose and all types of water except steam. It is claimed that the nozzle not only effects a considerable saving in hot water but reflects back to a saving in oil or coal by the consequent lowering of demand on heating methods.

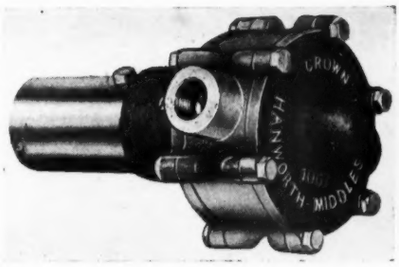
The body of the Meynell Spray Nozzle is made from high-quality bronze and all working parts are manufactured from suitable hard-wearing alloys. It is covered by a renewable rubber cover, which prevents scratches and other damage. It is operated with a trigger-type, shut-off valve and a variation of water discharge from a mist spray to a pencil jet is controlled by hand pressure on the trigger. The spray nozzle is fitted with nylon bushes: it is normally supplied with two adaptors for use with either $\frac{1}{2}$-in, or $\frac{3}{4}$-in. hose. A fire brigade fitting is also available.



The Meynell Spray Nozzle Mark I delivers 2½ gal. of water per min. at a pressure of 25 lb./ sq. in. The Mark II delivers 1 gal. / min. at the same pressure; an uncontrolled ½-in. hose gives an output of 40 gal./min. at 25 lb./sq. in.

Vane-Type V-Pump

The Crown Self-Priming Vane Pump (Crown Engineering Company, Hanworth, Middlesex, England) consists essentially of the body, front and back cover, which are machined from high-quality gun-metal castings; paper gaskets seal the joints between the body and the covers. These units house and locate the metal rotor, which incorporates the rotor blades, the steel driving shaft, gland packing and gland nut. The protective-coated, steel p.t.-o. coupling is fitted to the shaft by means of a high-tensile-steel bolt.



The Crown Engineering Company Vane-type Pump. The ½-in. model gives an output of 350 gal./h. at 0 lb./sq. in.; the ¾-in. model gives an output of 800 gal./h. at 0 lb./sq. in.

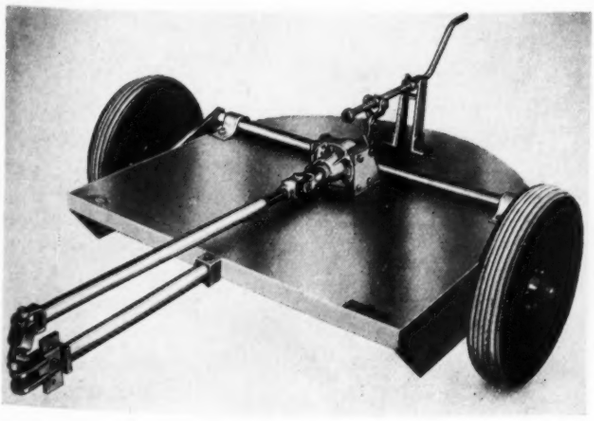
Application

This pump has been specially designed for use with water, insecticides and certain chemicals, and is particularly applicable to the agricultural industry where the power is taken direct from the p.t.-o. shaft of tractors. One of its outstanding features is the coupling, which can be adapted to fit, with a key, direct onto the p.t.-o. shaft of all standard tractors, so eliminating the need and cost of mounting brackets, belts and pulleys, chains and sprockets etc.

Computor for Sprayers

Orchard and row-crop growers can determine the correct nozzling for their sprayers, regardless of make or model, in a matter of seconds with a new 'quick' computer, which gives required gallons per minute by simply knowing the number of gallons to be applied per tree (or acre), the spacing of trees (or width of swath for row crops) and the speed at which the sprayer will travel. The scales on one side give orchard gallonages, and those on the other side are for row-crop spraying.

The new device is equally effective for air-type orchard sprayers or for



The Caldwell S-5 rotary cutter will cut a 5-ft. swath and is equipped with a reversible spring-steel blade of special alloy

The new Massey-Harris 760 mounted disk Harrow for Category II hitch. It is available either as a 7-ft., 18.-in.-dia., 24-disk model or as an 8-ft., 28-disk model

high-pressure, gun-type equipment and is accurate with either concentrated, semi-concentrated or dilute solutions. In row-crop or field spraying, whether an air-type, boomless or boom sprayer is used, the computer shows exact gallonages that are easily converted to the size of nozzle disc or cap required. Varying rates of travel and any number of rows or width of swath are covered.

The computer is now available at John Bean dealers throughout the country or can be obtained from John Bean Division, Food Machinery and Chemical Corporation at Lansing 4, Michigan or San Jose, 1, California, U.S.A.

Sholderhi

The Sholderhi, manufactured by A. J. Mackaness Limited, Billing, near Northampton, and exported solely by British Overseas Engineering and Construction Corporation Limited, 30 Queen Anne's Gate, London, S.W.1, was designed to meet a need for a mechanism that would shorten loading time and reduce transport costs when loading sacks etc. onto lorries and so on.

This loader consists of a sack cradle, or loading frame, which is hooked onto two horizontal stub axles of a hydraulic ram assembly fitted beneath the truck tail board. The ram bears on the lower part of the inboard end of the cradle and, as it extends, causes the cradle to rotate on the stub axles until it is vertical. A strap runs the whole length of the cradle, being attached to the cradle frame at the outer end and hooked onto a banana link at the inner end which operates the valve controlling the ram.

When a sack is placed onto the cradle in the lower position the strap is depressed, thus drawing on the banana link and operating the valve automatically. The cradle raises the sack to the height of the shoulder of a man standing on the rear of the truck platform. It stays in this position until the sack is removed; this action releases the strap and, therefore, the valve and the cradle return, again automatically, to the loading position. The speed of this operation allows a loading speed of five sacks per minute if required, and this version has a capacity of 3 cwt. (150 kg.).

The sack is taken on the shoulder and the Sholderhi automatically returns to ground level for the next load

The hydraulic circuit consists of p.t.-o. and pump unit, reservoir and ram assembly inter - connected by special rubber hose. The hydraulic fluid is supplied by the high-pressure hose at about 600 lb. per sq. in. direct from the pump unit to the two-way operating valve on the ram assembly. When this valve is closed the oil supply bypasses the ram and returns by means of the low-pressure hose through the reservoir to the pump. On operating the valve the bottom end of the piston is subjected to the high-pressure supply and at the end of the stroke a stop valve automatically comes into operation, feeding off excess oil into the low-pressure side, thus keeping the piston at its extreme position. On releasing the original valve the high-pressure supply is cut off and the fluid contained in the cylinder is forced back into the low-pressure side by the weight of the cradle on the piston. The engine of the truck is, of course, ' ticking over ' throughout the operation, the p.t.-o. gear having been previously selected.

Mounted, Tandem Disk Harrow

Available in two models, the Massey-Harris 760 Mounted Tandem Disk Harrow (Massey - Harris - Ferguson, Coventry, England) is designed for attachment to the Massey-Harris 745 Tractor and other popular models fitted with Category II, three-point linkages. They are designed for effective clod breaking and the thorough cutting and preparing of seed beds immediately following ploughing, or the disking down of heavy cover crops immediately before ploughing. The three-point linkage attachment allows a high rate of manoeuvrability and control, and by lifting the implement for transporting it prevents the occurrence of wear to blade disks and bearings commonly encountered with harrows of conventional design when travelling on hard surfaces. Two levers, easily accessible from the tractor seat, permit individual gang adjustment when required. Weight boxes, situated either side of the link pins, allow additional weight to be carried to give increased penetration without impairing stability in transport. Each gang has an adjustable scraper assembly for efficient cleaning of the disks; the

scrapers may be adjusted separately or in unison with the complete assemblies. The implement is raised by a finger-tip control for transport.

Slow-speed Tractor Attachment

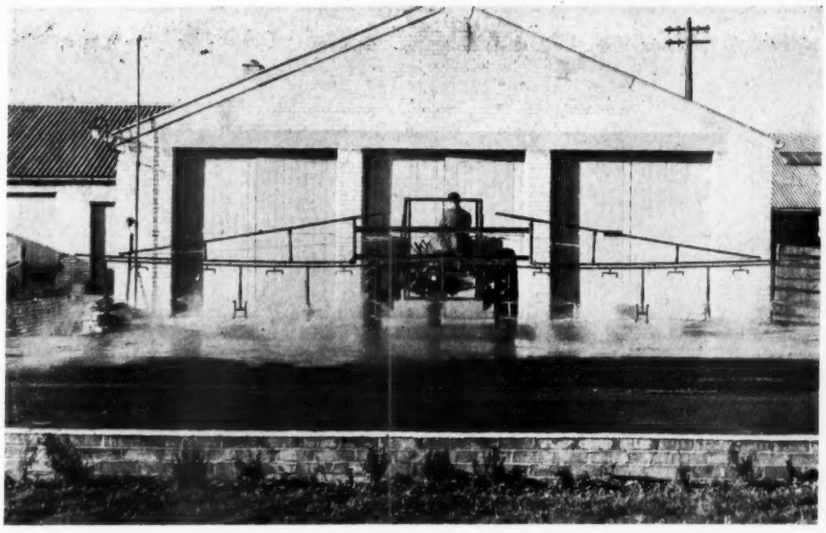
The International Harvester Export Company, 180 N. Michigan Ave., Chicago 1, Ill., U.S.A. is now offering its Hydra-Creeper attachment for the Farmall 400 tractor. The attachment previously had been available only for the Farmall 200.

Hydra-Creeper provides four creeper speeds, ranging from $\frac{1}{5}$ to one m.p.h., at full power. It is used primarily for transplanting vegetables, tobacco, flowers and nursery stock, for planting flower bulbs, and for special harvesting jobs where slow speeds are essential.

The Hydra-Creeper attachment consists of a hydraulic motor driving a chain-and-sprocket speed reducer. Hydraulic power is supplied by the tractor's engine-mounted Touch-Control pump. Power is transmitted through the p.t.-o. shaft to the tractor's regular transmission. The unit is easy to attach or detach and does not interfere with the use of regular equipment at normal tractor speeds.

Brussels-sprouts Sprayer

Information has been supplied by the manufacturers, Dorman Sprayer Co. Ltd., Ditton Walk, Cambridge, Cambs., on their latest production, the Dorman Mounted Brussels-sprouts Sprayer. It is a modification of the 150-gal. saddle-tank cotton sprayer for the application of various insecticides on brussels sprouts.



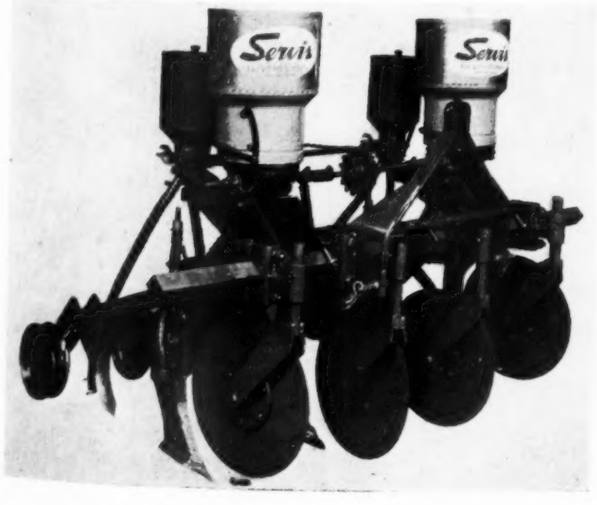
The Dorman 150-gal. Saddle-Tank Brussels-sprouts Sprayer with boom extended and showing the 11 lances and nozzle arrangements. The nozzles can be adjusted to suit the crop.

The implement consists of two 75-gal.-capacity, all-welded steel tanks, arranged one on either side of the tractor with sufficient room left between tank wall and engine to carry out minor repairs if necessary. Each tank is treated internally with the new ' Epikote ' lining and has its own individual filter basket and close-fitting anti-splash lid.

The stainless-steel and bronze pump has a large capacity and gives an output of 39.4 gal. per min. at 100 lb. per sq. in. Straight-through filling can be effected with this pump at a rate of 50 gal. per min. (filling completed in three minutes).

The spray boom has a wide range of height adjustment. The outer sections are sprung vertically and laterally to obviate damage. The lances are fitted with four nozzles each and the boom carries additional nozzles to ensure complete top cover. Eleven lances are supplied to treat this number of rows per run.

The complete machine can be arranged so that a cab can be fitted to the tractor if required.



The coulters on the Servis 'pasture renovator' are equipped with two, dust-sealed ball bearings each, and cut sod or trash to predetermined depth. After placement of fertiliser and offset planting of seed, spring-mounted, concave C.I. press wheels press seed and sod back into place.

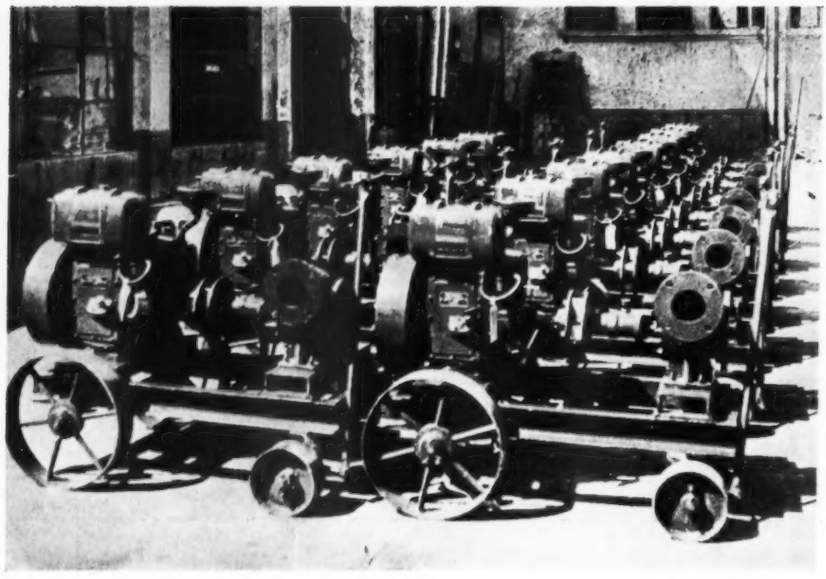
Double-deck Soil Builder

A pasture renovator and multi-purpose tool has been introduced by Servis Equipment Company, 1,000 Singleton Boulevard, Dallas, Texas, U.S.A.

It is designed for placing commercial fertiliser up to 6 in. deep, and for planting legumes or grasses on the surface at the same time. It is equipped with 18-in.-dia., castor-mounted coulters in front of four openers at approximately 20-in. spacings for cutting sod; offset seed openers and drops, with rear spring-mounted press wheels for pressing the seed into the ground.

With a centre, rear-mounted drive wheel and tool-bar mounting, the flow of fertiliser and seed stops immediately when the tool bar is lifted. International and easily removed fertiliser boxes and Planet Jr. brush feed and planter boxes are employed.

The implement fits three-point lift as well as tool-bar-equipped tractors. The manufacturers claim that 100 lb. of fertiliser properly placed under the grass roots is more effective than 400 lb. placed on the surface.



National AH1 mobile pumps sets at C.V. Castro and Co.'s works in Cairo, Egypt

Mixer and Mincer

The machine known as the 'Peck-Mix' is manufactured by George Tweedy & Co. Ltd., Chipping, Nr. Preston, Lancs., and was designed for mincing root crops and vegetables and at the same time to mix these with meal, for use in piggeries etc. The machine has also proved suitable for breaking down bread and biscuit waste.

The 'Peck-Mix' Major, for the larger farmer, operates on the same principle as the standard model but has a rate of output for root crops of 6 tons per hour. The 'Peck-Mix' is easily operated by unskilled labour, male or female, without previous training. An advantage is that a stone in the foods being processed will not break or damage the cutting plate as the rate of motion throws the stone round the inside of the container and there are no corners or castings to break. The cutting plate is made of stainless steel and it is guaranteed to retain its cutting edge. Both models are available in the motor-driven form or as belt-driven models.

Crop Sprayer

Chafer's 250 Q.F. (J. W. Chafer Limited, Milethorne Lane, Doncaster, Yorks, England) has been designed especially for large farmers and contractors and it will spray most crops and chemicals at present in common use with the utmost efficiency.

It can be operated by the farmer's own tractor driver. Every part of the sprayer has been designed with the minimum of working parts to lessen trouble.

The pump is driven from the tractor p.t.-o. and is so arranged as to give minimum pressure variations at different tractor speeds. Lubricated taps are fitted and can be operated from the tractor seat. The wheel track is adjustable and the clearance under the sprayer is more than that under the tractor itself. Mechanical agitation is fitted and it will stir any of the commonly used spray chemicals. Potato underleaf down-pipes can be fitted and this sprayer is very suitable for row-crop work. All parts of the sprayer coming in contact with the spray liquid are specially treated and are non-rusting.

A tank-level gauge is fitted to show the contents, also a pressure gauge and a speedometer—this is most important as with precision spraying it is necessary to know exactly what speed the sprayer is travelling.

The spray bar is 32 ft. wide and special anti-drip features are incorporated.

Specifications

Pump. — Heavy-duty, centrifugal type, fitted with patent gland seal. Mounted on gear-box shaft.

Drive.—Hardy-Spicer flexible shaft from tractor p.t.-o. to specially designed speed-increaser gears in oil bath case, all fitted with ball or roller bearings.

Tank. — 250-gallon capacity; corrosion resistant.

Agitation. — High-speed propellor type (mechanical).

Filters. — Suction and main are monel metal of ample size and easily cleaned. Each nozzle is fitted with an individual filter.

Output.—From five to 120 gallons per acre.

Track.—Adjustable from 56–74 in.

Taps.—Lubricated, easy action with ample gland area.

Wheels. — 800 × 19, fitted with Timken roller bearings.

Egyptian Mobile Pump Sets

Mobile pumping sets for farm irrigation have been developed by C. V. Castro and Co., of Cairo, the Egyptian agents of The National Gas and Oil Engine Co. Ltd., Ashton-under-Lyne, Somerset. The sets are assembled in Castro's own workshop.

They are designed to irrigate small farms of an average size of 30 to 40 acres. Water is pumped from open canals to the land for the cultivation of all types of local crops.

The sets are simple and sturdy and each consists of a National AH1 diesel engine and a locally made 4 in. × 5 in. pump mounted on a four-wheeled trolley.

The engine is of the single-cylinder, horizontal type, developing 5 b.h.p. at 1500 r.p.m. It is cooled by means of a by-pass from the pump, and the drive is through a flexible coupling with interlaced flat belting between pegs fixed to flanges on the pump and engine shafts.

The base-plate is of fabricated steel. The design of the bearers on the trolley, together with the rectangular base of the engine, permits a large area for weight disposal over the base-plate. The trolley is fitted with a swivel-axle and steel wheels with plain bearings, and grease cups. The swivel axle means that the set can be towed easily by hand or tractor.

Pump output with engine running at 1500 r.p.m. (5 in. suction; 4 in. delivery)

Volume per hour,		*Head,*	
gal.	*cu. m.*	*ft.*	*m.*
34,100	155	12	4
29,700	135	16	5
25,800	117	20	6
19,800	90	23	7

WORLD CROP REPORTS

ISRAEL

Peanuts

The area planted with peanuts this year will be approximately 60% larger than last year's area of 60,000 dunams, the Ministry of Agriculture spokesman has announced.

Mr. Kaddish Looz, the Minister of Agriculture, has appointed a committee, headed by Mr. Z. Zur, Deputy Minister, to seek ways and means of increasing the area planted and to recommend a more profitable way of selling the crop. In 1955 only 20% of the crop was exported, and too little of the rest was utilised by local industry.

YUGOSLAVIA

Wheat

Yugoslavia has sown about 1,950,000 hectares of land to wheat, industrial crops and other winter crops, according to the Federal Bureau.

Last year 2,837,000 hectares of wheat, 2,460,000 hectares of maize and 373,000 hectares of industrial crops were sown. The remainder was used for growing vegetables.

ARGENTINA

Scattered rains and cool weather during early February were favourable for growing crops. The official crop report for January said that abundant rains had altered the general outlook, which was bad during December, owing to drought conditions, and this favoured intensive late sowings.

The first official forecast for the 1955–56 *wheat crop* is 4,550,000 tons, compared with 7,690,000 tons produced in 1954–55, but this is generally considered pessimistic as yields are proving fairly good. The linseed crop suffered more than wheat, and production may not exceed 300,000 tons, which would be the lowest figure ever recorded. The *oats*, *barley* and *rye* out-turn should be above the average of recent years.

The first official estimates of the area sown to *maize* in 1955–56 put the figure at 2,860,000 hectares compared with 3,001,500 hectares which yielded 2,546,000 tons. This season's production may be as high as five million tons despite the lower acreage.

LEBANON

The present production of apples in Lebanon is estimated at 18,000 tons. Production in 5 years time is likely to rise to 80,000 tons.

LIBYA

Locust swarms were seen in the coastal belt of Tripolitania during November and early December. The swarms, estimated as covering 20 sq. km., were sprayed from the air by poison and attacked on the ground. Reports that they were totally destroyed may be over-optimistic.

The first rain for two months fell in Tripolitania on 10 December and continued for several days. It is hoped that this late fall may have saved this part of the country from a complete harvest failure.

CANARY ISLANDS

The *tomato season* began about mid-October, and on figures available to date some 3 million baskets, each of 6 kg. net, were shipped on consignment to the United Kingdom market out of a total export of some 3,700,000 baskets.

As was expected, increased competition from Alicante district was damaging to the Canary Islands trade and, so far, losses have been incurred.

Bananas.—Production is perennial, but cuttings are smaller during the winter months. Even so, there is a tendency at the end of December for production to exceed demand. Contracts for 1956 are slow, but it is reported that a purchasing group of German buyers have agreed to take 35,000 tons at the reduced price of £35 a ton f.o.b., shipments to commence in February 1956. As a result of anxiety for the future of this trade, more care is to be exercised in the cutting, packing and transport of bananas, to safeguard the keeping qualities of this delicate variety.

MEXICO

Cotton.—The world cotton situation continues to be a vital preoccupation in Mexico. It is estimated that the fall in the price of cotton has already cost Mexico some 300 million pesos and there is still an unexported surplus estimated at 500,000 bales. The situation is aggravated by the fact that, owing to unseasonable rains during the 1954–55 season, an abnormal percentage of the crop is below standard.

Henequen.—By a contract signed with the Banco Nacional de Credito Ejidal, the henequen manufacturers of Mexico, organised as Cordeleres de Mexico, have purchased the whole 1956 crop of henequen, estimated at 400,000 bales, at a price of 2 pesos 50 centavos a kilo of raw fibre, the total sum involved being 150 million pesos. The Bank undertakes not to export any henequen. There have been reports of proposals to replace henequen by true sisal cultivation.

JAPAN

It is reported that as a result of the exceptionally good 1955 rice harvest the M.I.T.I. are recommending that direct Governmental control of the sale and purchase of rice should be removed and replaced by free marketing. It is claimed that this will reduce the present price of black market rice. The Ministry of Agriculture and Forestry are said to oppose the plan on the grounds that the general rice situation is still unpredictable.

The Minister of Agriculture and Forestry estimated that the agricultural production index for the 1955 fiscal year would reach 120 as compared with the 1954 figure of 105. The previous highest figure since the war was 107 in 1952. The Minister attributed the rise to the unusually good crops of rice and cereals.

VENEZUELA

Coffee and cacao

The Venezuelan Chamber of Agriculture confirmed in November that the 1955–56 coffee crop will total only about half that of the 1954–55 crop which was approximately 890,000 bags of 60 kg. This further fall in production (the 1953–54 crop was only 689,000 bags), which has again been attributed to unusually prolonged and heavy rains, has underlined the need to introduce improved and more economical methods of cultivation. The reduction in the cacao crop, due also to unfavourable weather, is not quite so serious.

URUGUAY

Threats of drought continued into December but were finally dissipated by heavy and well-distributed rains at the month's end. Pastures have in general withstood the earlier dry weather and the condition of livestock is satisfactory.

Unfortunately, the rains were accompanied by violent winds which caused some damage to crops. However, *wheat* harvesting suffered little interruption. Excellent yields continue to be reported and the harvest is estimated at some 900,000 tons which should provide an exportable surplus of some 750,000 tons; which includes 150,000 from last year's crop. Earlier dry weather has affected adversely the *sunflower-seed* harvest which is not now expected to cover the requirements of the country.

Spec. Reg. Inform. Serv.

ENGLAND AND WALES

Agricultural report. Agricultural conditions in England and Wales on 1 February, 1956, have been summarised by the Ministry of Agriculture, Fisheries and Food.

Conditions generally were not favourable for cultivations during the month but on the whole work is well forward for the time of year. Autumn-sown crops are strong and healthy. The condition of livestock is satisfactory and lambing prospects were favourable. Supplies of winter keep are expected to be sufficient.

Weather condition:

The weather during January was very changeable. After widespread gales on the first day the rest of the first week was more settled, although there was frost in the east and south-east. During the second week there were substantial snowfalls in eastern areas. The weather was generally changeable throughout the third week, though fairly dry and sunny, but later in the month considerable snow fell over much of England. Milder air, preceded by snow and rain, returned on 25 January but temperatures were slow to rise in northern districts where further snow fell. It continued mild in southern districts with periods of heavy rain in places but on the last day of the month sleet and snow spread to all districts.

Sunshine totals were above normal in most districts and rainfall was above average in many areas, particularly in the south-east.

Cultivations and other field work

Fair progress was made in some areas during January but generally conditions were not favourable for cultivations; good progress had, however, been made before the weather deteriorated and on the whole work is well forward for the time of year. Good progress was made with manure carting, hedging and ditching.

Autumn-sown crops

Wheat is generally strong and healthy.

Barley looks well and is a strong healthy plant.

Oats are healthy and vigorous.

Rye is healthy and well forward.

Beans for stockfeeding have made progress and are generally satisfactory.

Potatoes

Reports on the condition of potatoes in clamps are generally favourable.

FRANCE

Wheat

The issue of export licences for seed wheat has been stopped with effect from 8 February by the French Secretary of State for Agriculture, owing to serious damage caused to wheat and other grains by the recent cold spell.

A Ministry of Agriculture communique said preliminary surveys revealed that serious frost damage had been done to grain shoots all over the country. It would take some time to determine the exact extent of the loss, but it appeared that a certain amount of replanting would be necessary. Seed exports would, therefore, be suspended and a census of all available supplies would be taken. As soon as exact seed requirements had been determined, all co-operative and commercial corporations would be contacted to organise the distribution of seed grains to farmers.

A Ministry spokesman said the damage was not expected to be as heavy as in 1947 when frosts in February reduced the wheat crop from an estimated 6,759,000 metric tons to 3,366,000 tons. Moreover, the situation was less serious in this instance in that sufficient seed grain for replanting was probably available, whereas farmers had no seed reserves in 1947.

INTERNATIONAL

Sugar

Licht's first estimates of sugar production in *Europe* made a very favourable showing compared with the previous season despite the eccentricities of the weather. For Europe, without Russia, the total was 280,000 tons more than in 1954–55, but still some 860,000 tons below the 1953–54 record. *Russia* was credited with a considerable increase to 3.5 million tons. The harvest has been attended with extremely good weather as a whole and in the *United Kingdom*, as in many other areas, it has been perfect.

No official news is yet forthcoming as to the size of the *Cuban* crop. The market anticipates a slight increase on last year's figure of 4.4 million tons.

Production of sugar in *Hawaii* had by 23 October, 1955, amounted to 957,365 long tons, according to *Sugar*, which compares with an out-turn of 886,629 tons to the corresponding date the previous season and a final figure of 961,923 tons. The record was established in 1953 with an output of 981,532 tons.

Belgian statistics for the past two campaigns, made up as at 31 December, 1955, are:

	1955–56	1954–55
Area planted (ha.)	60,644	59,981
Beets harvested (metric tons)	2,442,480	2,267,676
Yield (tons per ha.)	40.26	38.44
Sugar content (%)	16.46	15.87
Production (metric tons, raw value)	383,203	342,502

Czarnikow Rev.

INDIA

Rice

The all-India first estimate for rice for 1955–56 puts the current year's area at 65,916,000 acres, as against the adjusted first estimate of 62,542,000 acres for 1954–55, showing an increase of 3,374,000 acres or 5.4% over last year. Increase in acreage has been shared by almost all main rice-producing states, but is particularly marked in West Bengal, Bihar, Uttar Pradesh and Assam.